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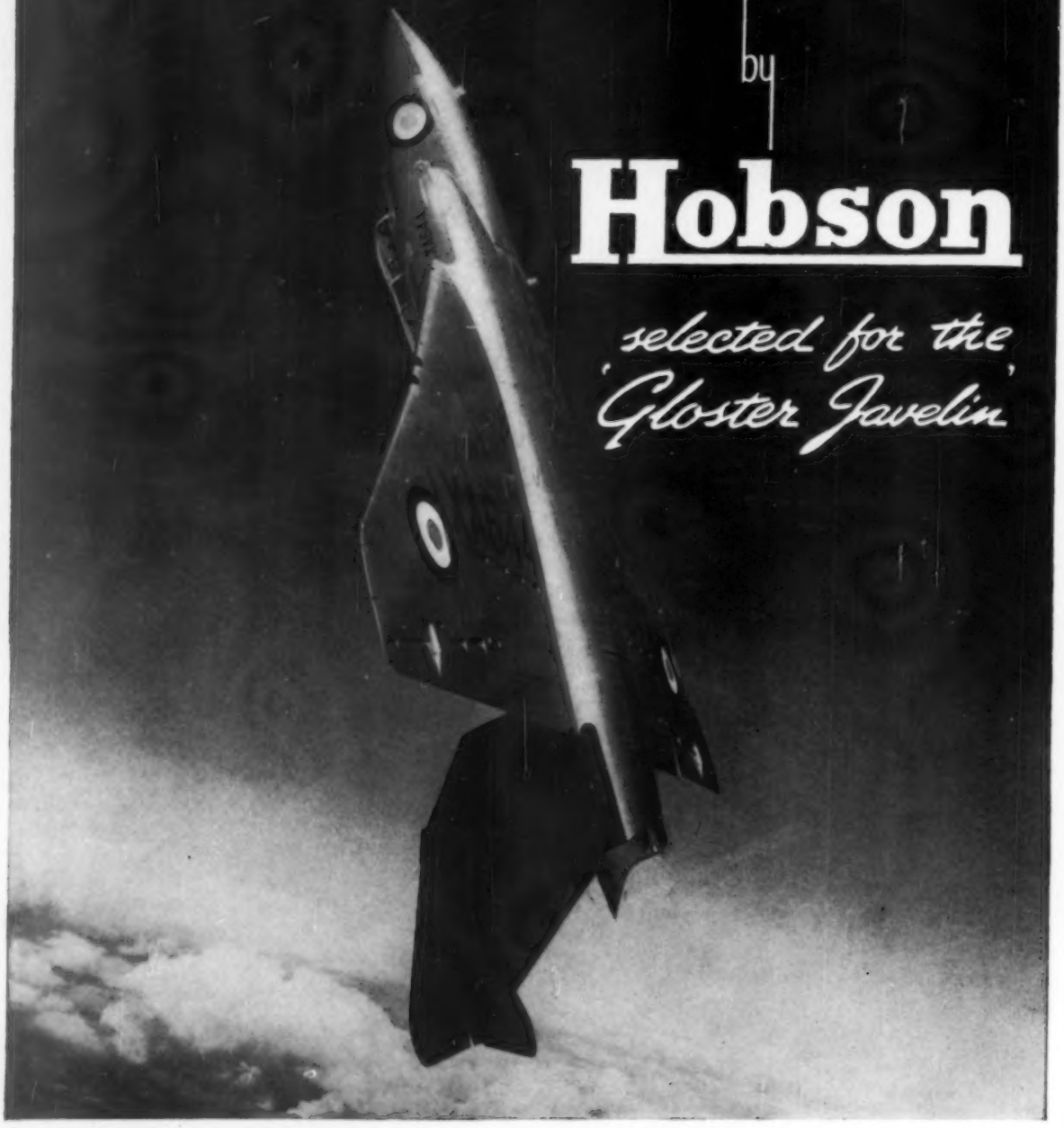

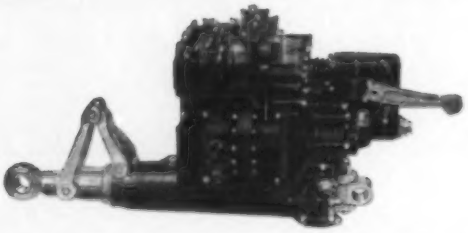

Many of Britain's leading aircraft designers are now specifying Hobson Power Flying Controls for operation of the primary control surfaces, including "All-Flying" or "Slab" tailplanes. The duplicated hydraulically operated single screw jack unit, as illustrated, is typical of Hobson units fitted to the Gloster Javelin.

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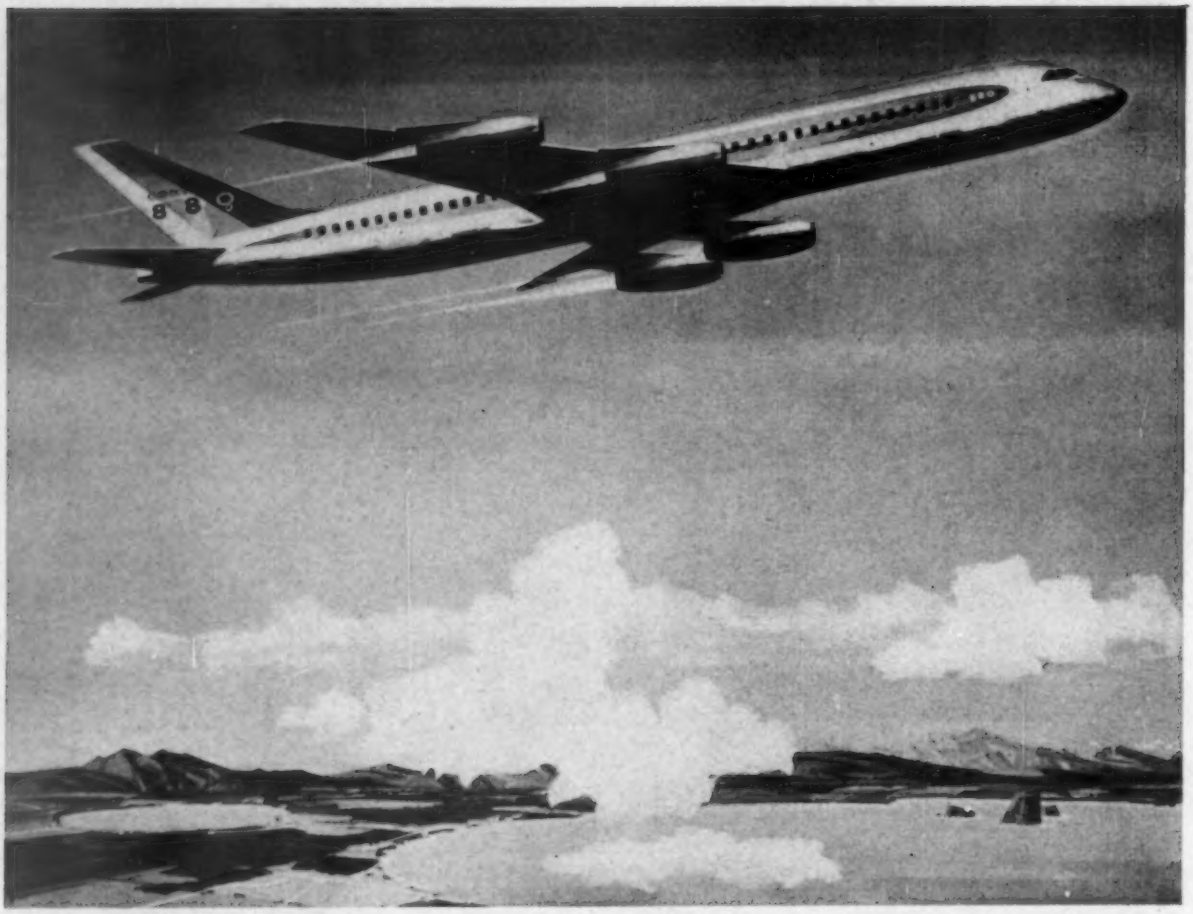


AIR CONDITIONING SYSTEMS are among the variety of products developed by Hamilton Standard for turbine-powered aircraft. The Convair 880 jet transport shown in artist's concept above will depend on a system employing Freon vapor cooling to remove 240,000 BTU's per hour from the air in the aircraft. A constant 75° F. will be maintained, with humidity held to 40% and cabin pressure at the equivalent of 8,000 feet when the airplane is at 35,000 feet.

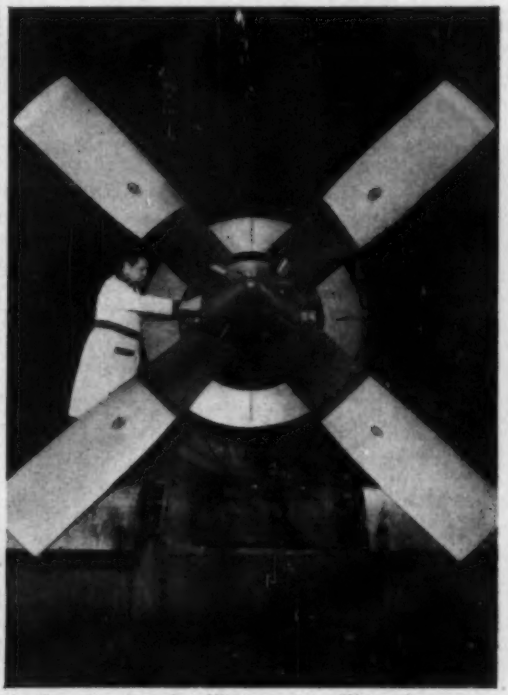
A complete cabin air change will be made every 2½ minutes. The system is lighter in weight and yet more effective than units in today's piston-engine transports. Similar Hamilton Standard equipment will be used in the Boeing 707s ordered by Trans World Airlines.

Depend on Hamilton Standard

Many of the best-known and most widely ordered aircraft of the jet age depend on Hamilton Standard equipment for their high performance and dependability. This equipment includes fuel controls, jet engine starters, air conditioning systems, hydraulic pumps, valves, and electronic components, as well as propellers for turbine engines.

Every type of American long-range turbojet airliner now in production will use one or more of these Hamilton Standard products. So will many of the medium-range jet and turboprop airliners, as well as a long list of turbine and rocket powered military designs—missiles, bombers, fighters, and transports.

For decades Hamilton Standard has been the world's leading designer and builder of propellers, which are used today by approximately 90% of the free world's modern airliners. Today new and expanded facilities for research, development, and production as well as years of aviation experience stand behind Hamilton Standard's superior jet age products for all aviation.



NEW HYDROMATIC PROPELLER for turboprop engines has been specified by KLM Royal Dutch Airlines for the Lockheed *Electra*, at left above. This four-bladed propeller will also be used on advanced Lockheed C-130B military turboprop transports. An integral oil control and a "beta control" to change or reverse pitch on the ground are among the new features. Hamilton Standard has worked for ten years on propeller development directly associated with turbine engine applications.

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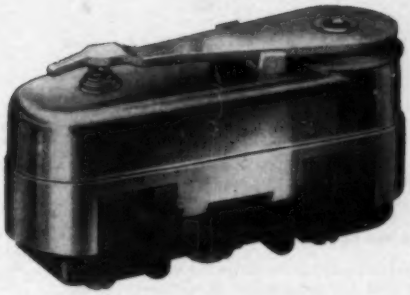

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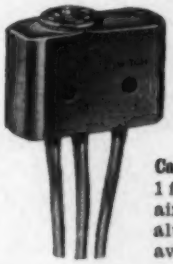

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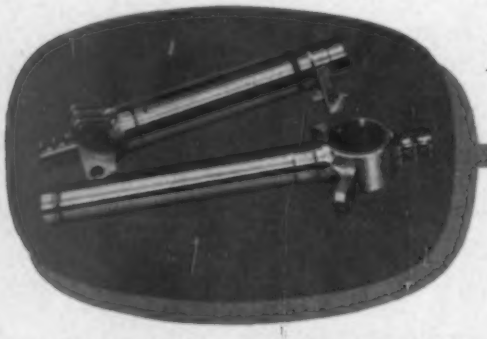

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Missionaries Needed

LAST week it was suggested in the national Press that B.E.A. are to urge I.A.T.A. to sanction fare-reductions of up to ten per cent. It was suggested also that the Corporation favours a fare-differential between propeller and jet aircraft. Neither confirmation nor denial of these significant possibilities was forthcoming from B.E.A. last week. Appropriately, the report coincided with Vickers' claims for the fare-cutting potentialities of the Vanguard (see page 179 of this issue).

There is no doubt that B.E.A. have always recognized the commonsense of fare-reductions. In their annual report they said:—

"B.E.A. has followed, and will continue to pursue, a policy of providing cheaper air fares in Europe . . . B.E.A. is seeking the agreement of other European operators to a policy of [economies], and will pass these on to the travelling public in the form of lower fares. . . ."

Increased efficiency of methods and equipment has achieved a steady reduction in the Corporation's unit-costs of production; the logical sequel—coupled with an urge to promote new business—is a reduction of prices. But the history of fare reductions in Europe shows that they have always followed the transatlantic lead. The possibility that intra-European carriers, at the instigation of B.E.A., may set a price-cutting example is new—and refreshing.

The prop *versus* jet fare-differential issue is much more complex. It has implications which are world-wide. The majority of international airlines—having stocked up with jets—will not even agree that it is desirable in principle, because they regard it as an unfair penalty on the jet.

But it would be rash to imagine that the public would readily pay the same price for propellers as for jets. A differential of some degree is sooner or later inevitable. Initial token discounts will not diminish the great appeal of the jet; and they will furthermore establish a much needed basic principle in air transport that speed alone is a false idol, and that low operating cost deserves more devout worship. At present the manufacturing industry has no incentive to design for uncompromised low operating cost. Britain has missionary work to do in the furtherance of this cause. Last week's report that B.E.A. want a differential is heartening; but they need the full support of their sister Corporation, and of the Minister of Transport.

Money Isn't Everything

IMMENSE expenditure of money and manpower has given the U.S.A. three long-range ballistic missiles—Jupiter, Thor and Atlas—which are in a sufficiently advanced state of development for operational squadrons to be already under training in their use. But however impressive its launching may be, a big missile is worthless unless it can withstand the arduous conditions of re-entry, when its nose-cone and fore-body are raised to incandescence by friction with the atmosphere. The Soviet Union is believed to have been the first nation to solve this problem. Now America has also achieved success: Jupiter has completed two simulated operational missions over the full range right into the target area.

This is in itself an achievement of real consequence; and it is the more remarkable in that Jupiter, though now turned over to the U.S.A.F. for operational use with Strategic Air Command, is entirely the brain-child of the U.S. Army. In its development the Army Ballistic Missile Agency (director of development operations Wernher von Braun) have co-operated with several government bodies, industrial firms and universities in evolving the Jupiter weapon system. Their total expenditure on research into re-entry problems and nose-cone design and construction can probably be assessed at several million dollars. In contrast, the U.S.A.F. have spent about one hundred times as much on similar investigations; the nose-cone contracts with Avco and General Electric alone amount to $111,308,359 and $158,000,000 respectively. Doubtless the U.S. Air Force will similarly achieve success with the problem, but the fact that the U.S. Army have done so first shows conclusively that the biggest man does not always win.

GIRDER CRANE: With its massive steel-tube-girder fuselage, the first Westland Westminster—a "flying crane" version—is seen in this impressive picture. There is little to give scale except the pilot—six-footer "Slim" Sear (whose bone-dome is just visible)—and the Bristol Freighter wheels.

FROM ALL QUARTERS

A P.1 for Two

IT was announced last week that the English Electric P.11, a trainer version of the P.1, has been ordered for the Royal Air Force by the Ministry of Supply.

Like the P.1, the P.11 will be powered by two Rolls-Royce Avon turbojets and the full range of operational equipment is retained. One of the principal differences is that the forward part of the fuselage has been widened to accommodate two seats side by side.

Announcing the order, English Electric state that the structural design work for the P.11 was done by their aircraft division drawing office at Acton, London. This office, with a staff of 80, was opened late in 1950 and was also responsible for the structural design of the Canberra Mk 8. Aerodynamic design of both was done at the company's research and development centre at Warton.

Explorer IV

AMERICA'S fourth successful satellite was launched by the U.S. Army from Cape Canaveral on July 26. Like the Army's previous "Explorer" satellites, it was launched by a Jupiter C, which is basically an improved Redstone (much less powerful than the Jupiter IRBM). Explorer IV weighs 38.43 lb; thus, though it is tiny compared with the Soviet Sputniks, it is the heaviest American satellite so far launched.

Unlike those of previous Canaveral launchings, the orbit started in a north-easterly direction; altitude limits of the orbit are about 175 and about 1,365 miles, and the longitude limits are 51 deg north and 51 deg south. Airborne equipment includes four radiation counters (two Geiger, two scintillation) and two beacon transmitters (108.03 Mc/s).

H.P.111

DEPICTED in the accompanying artist's impression, the H.P.111 is a projected transport derivative of the Victor B.2; and Handley Page, Ltd., announce that details of its potentialities have been given to the R.A.F. The first news of the H.P.111 was contained in our issue of July 11 (p. 35). Handley Page confirm its ability to carry 200 soldiers or 60,000 lb of freight for 3,800 statute miles. In the tactical sphere it could carry 120 paratroopers, dropping four at a time. Employing blown flaps and reverse thrust from the engines (presumably four Rolls-Royce Conways), it is calculated to be capable of operating from a 1,000 yd strip with reduced payload.

TREBLE ONE is Handley Page's popular designation of the H.P.111 transport project, shown in this artist's impression and subject of a news item in column one of this page.

Re-entry at Woomera

ACCORDING to reports from Australia, plans are in hand for a series of re-entry experiments to be undertaken at the Woomera range. The largest vehicle to be employed will be the Blue Streak, which has already been officially mentioned by the Minister of Defence. Developed by D.H. Propellers, D.H. Aircraft, Rolls-Royce and Sperry, Blue Streak is stated to have a range of 3,000 miles and to be capable of acting as a satellite-launcher in addition to its design rôle of thermonuclear transporter.

The other vehicle will be the Black Knight. According to a correspondent of the *News Chronicle*: "The Black Knight, being developed by Saunders-Roe, is designed to solve the problem of getting a missile back into the atmosphere without it burning up. It generates a thrust of 100 tons and a roar which can be heard 50 miles away. It is said here to have been highly successful in tests at the British research station at Westcott, Bucks. Fired in a long, water-filled concrete spillway, the rocket made the biggest jet of flame ever generated in Britain. It is now undergoing captive tests on the Isle of Wight."

Capt. Iven C. Kincheloe

WE regret to record the death, in a flying accident last Saturday, of Capt. Iven C. Kincheloe, the U.S.A.F. test pilot who was to have carried out the Service trials of the North American X-15. He ejected from an F-104 shortly after take-off from Edwards A.F.B. (the F-104 has a downward-ejecting seat).

One of the most experienced and skilled test pilots in the U.S.A.F., Capt. Kincheloe had been training for some time as one of the team of three pilots destined to fly the X-15. He was a qualified engineer and had made many flights in the X-series rocket-powered research aircraft. In 1956 he set up the unofficial height record of 126,000ft in the X-2.

Seaslug Success

IT is announced by Sir W. G. Armstrong Whitworth Aircraft that, during recent trials of Seaslug—the Royal Navy's ship-to-air guided weapon—direct hits have been obtained on target aircraft by inert rounds. The trial firings have been made both from Aberporth and from the trials ship H.M.S. *Girdle Ness*. A propulsion test vehicle with a configuration similar to that of the operational weapon will be displayed for the first time at the forthcoming S.B.A.C. Show.

A.S.M. Appoint Chief Engineer

IT was announced last Monday that Mr. Sidney Allen, M.I.Mech.E., F.R.Ae.S., has been appointed chief engineer for all Armstrong Siddeley products except motor cars. He will be responsible to Mr. W. H. Lindsey, M.A., M.I.Mech.E., F.R.Ae.S., technical director.

Born in 1909 and educated at Wellington School, Somerset, Mr. Allen was apprenticed to Petters of Yeovil in 1926 and remained with them as a designer-draughtsman until 1934, when he joined Armstrong Siddeley. He subsequently became chief combustion engineer and, latterly, chief engineer (rockets).

In addition to their aero engines, cars and rocket motors, Armstrong Siddeley are now building air-cooled diesel engines and auxiliary gas turbines and air starters. They are to manufacture the large Maybach diesels under licence and have other projects in hand.

VTO in the U.S.S.R. Entering Russia's VTO test rig, recently demonstrated at Tushino and illustrated in "Flight" last week, is test pilot Y. Garnaev. Also in the picture is the rig's designer, A. Raphaelants.

AIRBORNE at Eastleigh is (right) the Saunders-Roe P.531 five-seat multi-purpose helicopter, powered by a Blackburn Turmo 600.

Proteus Approved for 1,600 Hours

FROM Bristol Aero-Engines earlier this week came news that the Proteus 705, turboprop engine of the Britannia 102, has been granted yet a further extension of overhaul life—from 1,300 hr to 1,600 hr. Bristol point out that "after only 18 months in service, the overhaul life now stands at a figure which normally takes several years to achieve." Already, it is understood, Proteus engines are being run on trial to 1,900 hours between overhaul.

Pratt and Whitney JT-12

NAMED as an alternative powerplant of such aircraft as the Jetstar, Sabreliner and CL-41, the Pratt and Whitney JT-12 is being developed as an easily made, cheap and versatile turbojet for aeroplanes, drones and missiles. Unlike earlier P. and W. axials it is a single-rotor engine, like the big Mach-3 J58.

YOUNG BROTHER: Smallest of Pratt and Whitney's turbojets, the JT-12 is referred to in the text. No U.S.A.F./Navy "J-number" has yet been allocated, JT-12 being a manufacturer's designation.

Initially rated at 2,900 lb dry, the JT-12 weighs 430 lb, resulting in the good thrust/weight ratio of 6.75. Its external appearance is well shown by the picture. Design was started in July 1957 and the first prototype ran in May. Last month a successful 15-hr test was run for missile applications, and sustained runs at full power have demonstrated an s.f.c. better than predicted.

AGARD Meetings

DATES announced by AGARD for its forthcoming functions include those for the avionics panel meeting at Cambridge University (September 4-6); and panel meetings at Copenhagen (October 20-27) followed by the eighth general assembly there (October 28-29). Details are to be announced later.

FIRST CANBERRA PR.9 on its maiden flight from Belfast on July 27, in the hands of Peter Hillwood of English Electric. All PR.9s are being made by Short Brothers and Harland, Ltd. Wing span has been extended by 4ft to 68ft, and the chord of the wing, inboard of the Rolls-Royce Avon turbojets, has been extended. The offset canopy distinguishes production machines from the PR.9 development aircraft flown in 1955.

Data on the P.531

IN the picture above is seen the first prototype Saunders-Roe P.531 helicopter during its initial test flight on July 20. This took place only 200 days after the start of detail design on January 1, and there is every indication that progress is most satisfactory. The pilot was Ken Reed, who has just been appointed chief helicopter test pilot, based at the company's helicopter division at Eastleigh Airport, Southampton.

Although the diameter of the four-blade rotor is the same as that of the Skeeter and the fuselage length is only 30in greater, the cabin is exceptionally capacious and provides comfortable seating for five. In the ambulance rôle the triple rear seat can be replaced by two stretchers. A pneumatic hoist can be fitted for rescue operations, external loads may be carried in slings or a net, and equipment can include full blind-flying instrumentation, auto-stabilizer/autopilot, cabin heating and de-icing, and a wheel, skid or float undercarriage. We shall publish a full description in next week's issue.

The following are particulars of the P.531 prototype: one Blackburn Turmo 600 free-turbine engine rated at 425 s.h.p. for 1 hr; main-rotor diameter, 32ft 6in; overall length (main rotor folded), 29ft; empty weight, 2,092 lb; gross weight, 3,800 lb; maximum range, 210 n.m. (280 n.m. with long-range tank); cruising speed, 100 knots; maximum endurance with long-range tank, 5.2 hr.

New Conways

PERMISSION has now been given for the publication of thrust-ratings for the Rolls-Royce Conway RCo.12, 14 and 15. These are 17,500 lb, 17,500 lb and 18,500 lb, respectively, and each is a guaranteed minimum figure. The Conway can thus fairly be described as the most powerful commercial aircraft engine in the world, with the sole exception of the Soviet AM-3 (which has a rating of almost 20,000 lb). Certain versions of the JT4A are probably about level-pegging with the Conway, although Pratt and Whitney are forbidden to disclose precise values.

The new ratings show that Rolls-Royce have exactly doubled the power of the Conway during the past five years, and it is now a highly developed powerplant for both military and commercial applications. The airline sales battle between the Conway and the JT4 has been most interesting. Initially nearly all sales went to the American engine—partly owing to the natural preference of American operators for an American engine and partly owing to

FROM ALL QUARTERS . . .

the fact that, at that time, Pratt and Whitney were able to claim that, whereas the J75 was flowing from the Hartford production line, the Conway had not been ordered at all—even by the R.A.F. Today the position is markedly different. Production of the military J75, although substantial, is on a scale far below that of the J57, and it is possible that the total run will be relatively short. Moreover, with the exception of the small batch of eighteen Martin P6M-2 flying boats, the only military J75s will be fighter engines. In contrast, a considerable (by British standards) run of military Conways is being delivered for the Handley Page Victor B.2. At the same time a steadily increasing share of the big-jet airline market has also come the way of the Rolls-Royce engine, which is 10-15 per cent cheaper than the JT4 while offering—on Boeing's and Douglas's own figures—considerably improved performance.

At the outset, Pratt and Whitney were able to "unsell" the Conway by various technical strategems, all more or less arguable. Their case has now been weakened by their own adoption of the by-pass formula (*Flight*, June 6). To date the Conway has been chosen by—in chronological order—Trans-Canada Airlines, Deutsche Lufthansa, Air-India International, B.O.A.C., Varig and Alitalia.* Installations have been developed for the Boeing 707-420 and Douglas DC-8, and the engine is fitted as standard to the Vickers-Armstrongs VC.10.

**Alitalia are understood to have placed an order in the last few days for Conways to power their DC-8s (of which four plus an option on two have been ordered).*

Taon Does It Again

ON July 23, piloted by Bernard Witt, the Bréguet Taon light strike fighter (Bristol Orpheus turbojet) established—for the second time—a 1,000 km closed-circuit speed record. Flying at 20,000ft, M. Witt recorded an average of 1,075 km/hr (668 m.p.h.). This figure is 30 km/hr superior to that attained by him on the former flight (April 25), though the circuit was again Istres - Cazaux - Istres.

HENRY FARMAN—AN APPRECIATION

THESE memories of the great Anglo-French pioneer—whose death on July 17 we recorded last week—are from the pen of W. F. Bradley, who was for nearly 40 years Continental correspondent of our associated journal "The Autocar."

FOR fifty-five years I was connected with the late Henry Farman and proud to have his friendship. Although generally looked upon as a Frenchman, Henry was born in Paris of British parents, his father—whom I knew very well—being Paris correspondent of *The Standard* and *The Tribune*. Together with his two brothers, Dick and Maurice, he took advantage of the French law allowing him definitely to claim British nationality on attaining his majority. It was not until just before the First World War that the three men, at different dates, became naturalized Frenchmen. [Mr. C. H. Gibbs-Smith's researches have shown that Henry Farman did not, in fact, acquire French nationality until 1937.—Ed.]

Thomas Farman encouraged his three sons to take part in athletic sports and particularly cycling. As art students, Henry and Maurice formed a tandem team and for a time were amateur champions of France. At the age of 18 Henry won the 400 km race from Paris to Clermont-Ferrand and in 1892 he won the 100 km championship on the Buffalo track, near Paris.

It was a natural step from the bicycle to the motor car and before the turn of the century the three Farman brothers were in business in the Avenue de la Grande Armée, under the title of Farman Frères, as agents for Panhard et Levassor, Renault, and Delaunay-Belleville. They opened what was then the biggest garage in Paris, the Palais de l'Automobile, in the Boulevard Pereire, which has remained unchanged and is now owned by Renault.

As in the case of most agents of that period, Henry and Maurice were keenly interested in racing. Henry took part in the 1903 Gordon Bennett race in Ireland and finished third on a Panhard. He also drove in the ill-fated Paris to Madrid race in 1903 and ran in the elimination trials for the 1905 Gordon Bennett in Auvergne. Having missed a bend his car went crashing down the ravine, while both driver and mechanic were caught in the branches of the trees. As soon as he had recovered himself, Farman took a packet of cigarettes out of his pocket and, turning to his mechanic (who was a few yards away on the branch of another tree), quietly remarked, "Pass me a match, Jules."

Henry Farman and "le quatrième frère."

In 1907 the Farman Frères business was a very flourishing concern, but it was just then that Henry became enthusiastic over flying—or, rather, attempts to fly, for nobody in Europe had really left the ground in an aeroplane. He placed an order with Gabriel Voisin for a biplane and the temporary use of an Antoinette engine. Farman had the option of buying this engine for 13,000 francs [equivalent to about £556 at that time].

Leaving the car business to his two brothers, Henry Farman devoted all his time to the new sport and on January 13, 1908, he won the Deutsch-Archdeacon prize by making a circular flight of one kilometre on the Issy-les-Moulineaux ground. This epoch-making exploit proved that the problem of artificial flight had been conquered and that the machines were not merely making hops ending in brutal contact with the ground. Not only did Farman teach himself to fly, but he showed his rivals how to use the elevator, and that it was necessary to bank the machine to effect a turn, while his experiences as a racing driver enabled him to get the best out of his engines.

Essentially British in physical appearance and in temperament, Farman displayed a quiet self-control, calm reasoning and lack of ebullition that gave him an advantage over the rival aviators of his period and brought him into the front rank, despite Blériot's sensational crossing of the Channel.

Turning his back on the motor business, he opened a flying school at Mourmelon—it was subsequently attended by large numbers of British pioneers—and, breaking away from Voisin, began to build his own machines. In a short time his brother Maurice became fired with enthusiasm for flying and started his own rival aviation business. It was not until after the First World War that the two brothers united forces and built up a powerful aeroplane and aviation engine business, to which they added the production of a high-grade car, designed by their chief engineer, the late Charles Waseige.

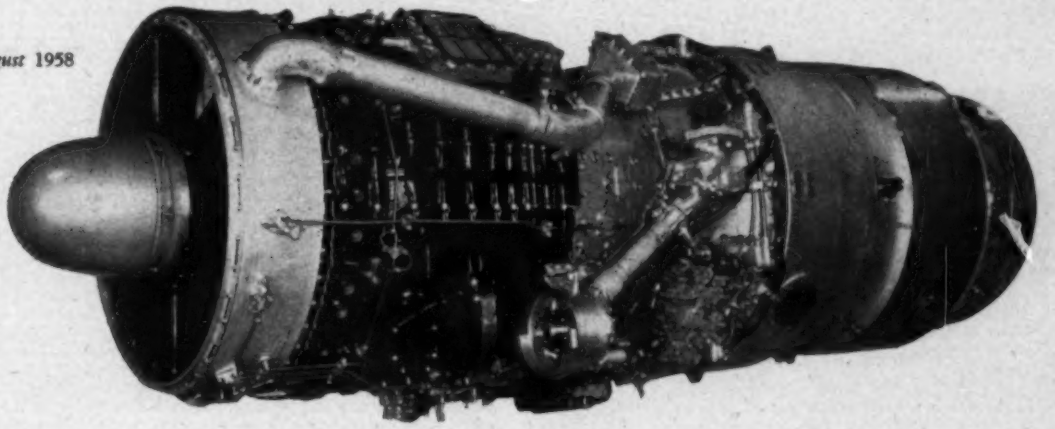
Under the Blum Government the Farman business was nationalized and later ceased to exist. Both Henry and Maurice continued their car activities and busied themselves with aviation on a reduced scale.

It was during the nursery days of flying that I realized the strong physical resemblance between Henry Farman and myself. During the first Rheims meeting a number of people gathered around my car clamouring for signatures. In vain I protested that I was not Farman. They refused to believe me and, in the hope of getting rid of them, I started to sign a false name. There was no retreat. When the captain of gendarmerie was convinced that he had seen Farman enter a house at Betheny, near Rheims, he called out his men and they formed a guard of honour when I emerged. After the police *commissaires* had taken up the joke and deliberately pointed me out as Farman, all resistance became impossible and I was generally recognized as "le quatrième frère."

During the German occupation Henry Farman lived in retirement on the western suburbs of Paris, and on my release from a German concentration camp I found he was a neighbour. Meeting him one morning afoot in the village street, I expressed surprise that he should be walking, for at 70 years of age he had remained a keen cyclist.

"The Germans chased me," he explained. "They caught up with me and stole my bicycle. Ten seconds more and I should have been in the forest, where I knew every track and they never would have found me." At that time bicycles were the only means of mechanical locomotion and were much sought after by the German troops preparing for a hasty retreat.

At 84 years of age Henry Farman was one of the very few remaining pioneers who had played a leading rôle in the bicycle, motor car and aviation movements. On several occasions I urged him to write an account of his brilliant career, but his modest disposition always induced him to refuse. W. F. B.



Thousand-hour Jet

ROLLS-ROYCE AVON RA.29 APPROVED FOR RECORD INITIAL OVERHAUL LIFE

AS briefly recorded last week, the Air Registration Board have approved the Rolls-Royce Avon RA.29 Mk 524 (10,500 lb static thrust), turbojet engine of the Comet 4, for a life between overhauls of 1,000 hours.

This is the longest initial overhaul life ever granted to a big transport aero-engine. Great Britain now has three civil turbines in the four-figure overhaul-life class, the other two being the Rolls-Royce Dart (1,800 hr) and the Bristol Proteus (1,300 hr).

Though the RA.29 Avon owes much to its military predecessors, it was designed specifically for civil (Comet and Caravelle) application, and it did not derive directly from any military Avon. This called for the intensive Comet 2E programme, described in previous issues of *Flight*, which B.O.A.C. finally completed last week (July 21) with a score of 7,700 RA.29 hours—much of this total having been amassed at a rate exceeding 20 engine hours per day.

A total of eight engines was involved in the Comet 2E programme (four installed, four spares), though in fact flying was concentrated upon only six engines in order to obtain high individual engine totals.

The original aim was to achieve, by the time B.O.A.C. Comet 4 operations began, an overhaul life of 500 hr. Comet 2E RA.29 engines were stripped and examined by the A.R.B. at 250, 500, 750 and 1,000 hr. The two engines which were removed and stripped at 1,000 hr were engines 35002 and 35007.

These two stripped engines, now on private display at Derby, were last week examined by *Flight*. Fretting appeared to be the main cause of such rejections as there were, particularly around the nozzle guide vanes and discharge nozzles. Rolls-Royce's two main lines of attack on the fretting problem are (1) metallurgical, to increase wear-resistance of adjacent components, and (2) mechanical, to separate components to avoid fretting altogether.

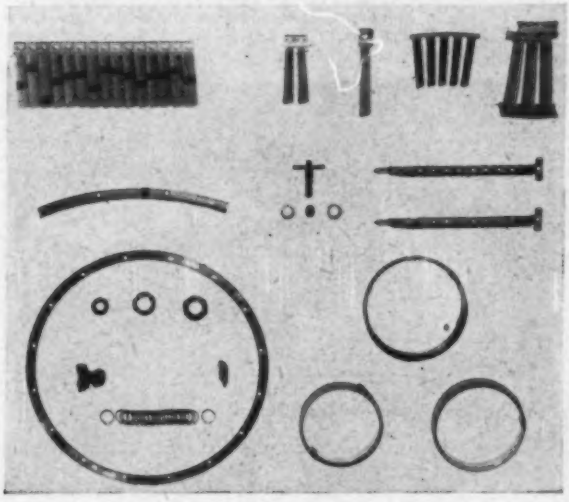
There were no troubles due to the injection of foreign matter, though the compressor and stator blades of one engine appeared to be not quite so smooth as those of the other. There were no temperature troubles in the hot end of the engine (the flame-tubes of 35002, having now run 1,250 hr, have already been built into a new engine for running to a further 500 hr). Both engines were test-run before their strip, and were within the new-engine acceptance limits.

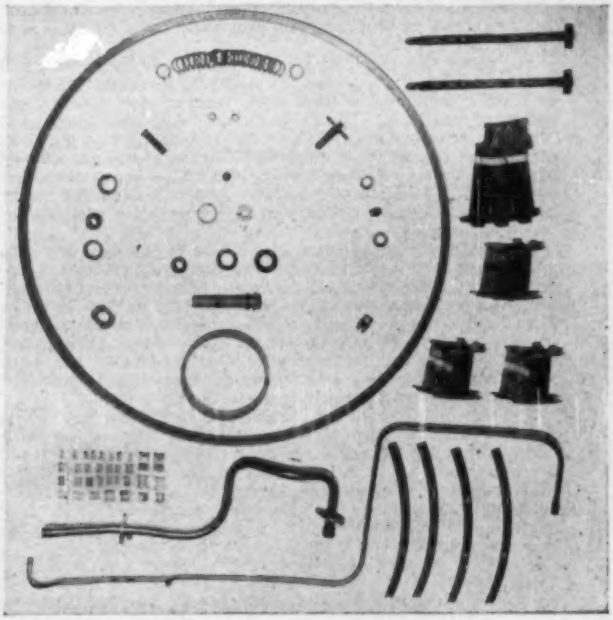
Throughout the Comet 2E programme there was only one unscheduled engine removal. This was due to excessive slipper-pad wear and consequent seizure of the fuel pump on one engine, following which the engine was removed for investigation. This resulted in a temporary restriction of fuel-pump life until the cause of the wear had been determined and action taken.

Unscheduled removal of fuel control units was higher than that acceptable for normal airline operation, owing to the pre-production modification standard of the earlier units installed, though engine 35002 has run the whole 1,250 hours of its life without the fuel control unit requiring any attention.

Only one condition is attached to the RA.29's 1,000 hr life: B.O.A.C. will be asked to submit for examination the first two engines from the Comet 4 fleet to reach 800 hr, and the first two to reach 900 hr.

This collection of RA.29 components represents items considered unfit for a further 1,000 hr of service, following the strip-down of two Comet 2E engines—Nos. 35002 (left) and 35007—after 1,000 hr of simulated airline service. Value of these parts is around £150 and £350.





All-Agricultural Helicopters?

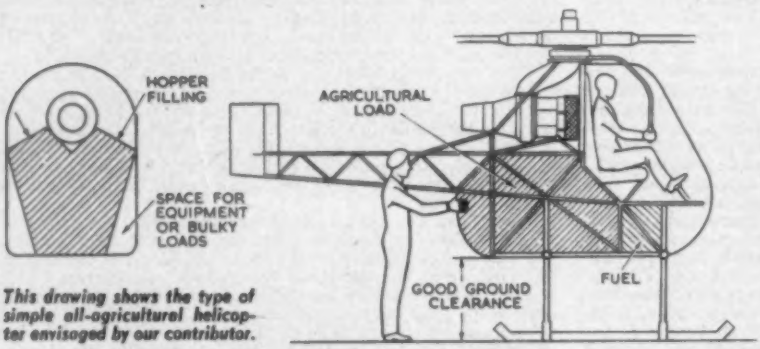
SOME REQUIREMENTS AND HOW THEY MIGHT BE MET

By S. W. G. FOSTER, A.F.R.Ae.S.

HELICOPTERS are well established as agricultural aircraft, but in the maiority of cases old designs are in use, adapted as efficiently as possible within the framework of the existing layout to perform the wide variety of duties called for. The possibilities of designing a helicopter specifically for agricultural work duties provide, in the writer's view, an interesting subject for discussion.

The old argument, helicopter v. fixed-wing aircraft, is a familiar one. Each type has its advantages, and each will continue to be used in its own sphere. For small-field work, where there may be no landing sites, or only those hemmed in by obstructions, such as hills, woods, power cables and buildings, the advantages of the helicopter are obvious. Another advantage of the helicopter is that the rotor downwash assists in getting the applied chemical to the underside of the crop leaves.

In most kinds of agricultural work the rotating-wing aircraft can score over the fixed-wing type on every point but that of operational cost. Therefore the design of our "all-agricultural" helicopter must be of the simplest nature, with low production and up-



This drawing shows the type of simple all-agricultural helicopter envisaged by our contributor.

keep costs in view. The aircraft shown in the sketch would be built to the cheapest structural considerations, with rugged steel tube work and no unnecessary equipment.

Extensive use could be made of resin glass-fibre and plastics for covering where required. Simple moulding technique on inexpensive moulds could be employed. Maintenance would be eased, as tears and dents can be easily repaired with resin, glass-cloth and a knife. Field splices can be made if necessary. In comparison with an all-metal-covered structure, a plastic assembly could be produced in about one-quarter of the man hours and at a similar proportion of the tooling costs.

The power unit and rotor system must be of the simplest kind, as low maintenance-time and consequently increased utilization are mainly bound up with these items. A pressure jet system might well be adopted, e.g., a Blackburn Palouste delivering compressed air to the rotor system, with a secondary bleed to give the compressed air for spraying purposes, thereby obviating separate pumps with their attendant periods of overhaul and maintenance in the field. The Palouste, it is understood, is being developed by Blackburns to give a pressure ratio which would be adequate for spraying chemicals.

The simple design of rotor head which can be used with the pressure-jet system further underlines the saving in cost. A tip-driven rotor, being torqueless, does away with the normal tail rotor with its complicated drive. A small rudder or air duct could be fitted for extreme low-speed control if required. With no gears, clutches, shafts and links as in the conventional transmission system the pilot will not experience vibration fatigue; and if the rotor diameter were kept to a minimum, then with clever designing drag-hinges and dampers could be eliminated.

The reserve of power which could be obtained from the Palouste would be desirable to allow full utilization in high and hot territories, where much work is available. Another advantage would be that no warm-up period would be required, as the engine reaches full power as soon as the turbine is up to speed; this is an important point where quick turn-round is needed. A speed governor could be arranged on the turbine to assist the pilot and relieve the necessity for frequent use of the twistgrip and collective-pitch lever and constant watching of rotor r.p.m.

All controls should be of the simplest form; a hanging cyclic-pitch lever, for example, would obviate the extra linkage for a floor stick, and there could be thumb-switches or levers on the stick for trimming. Indeed, the design of the control handgrips should be studied as closely as are the power levers on some fixed-wing aircraft, where numerous controls must be condensed into a very small space. Instruments would be kept to a minimum, with accommodation left for various special-equipment indicators. The pilot's comfort deserves particular attention, as the degree of concentration necessitated by prolonged periods of low flying and continuous turning and landing results in fatigue after four or five hours. Cooling may be necessary in some tropical locations, but in such conditions canopy removal would be of assistance. There should be good all-round visibility, especially downwards, with clear panels in the floor.

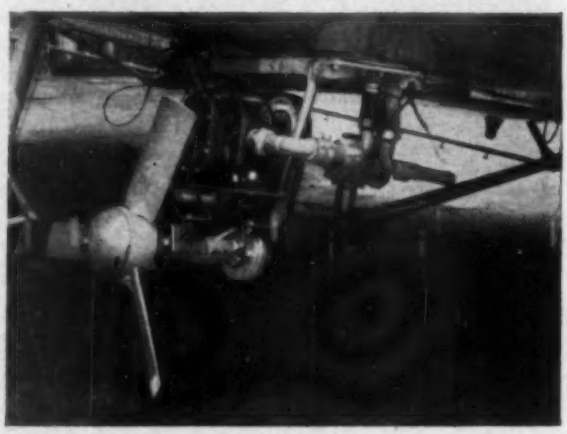
From the safety aspect, the pilot should be located to the port side and not immediately in front of the engine. All contents of hoppers, tanks and other heavy loads should be quickly jettisonable in an emergency, although with the helicopter the margin for error may in this case be wider. Attention should also be given to fire hazards attendant upon the use of some spraying liquids; intelligent location of fillers and shrouding of hot areas should be adopted.

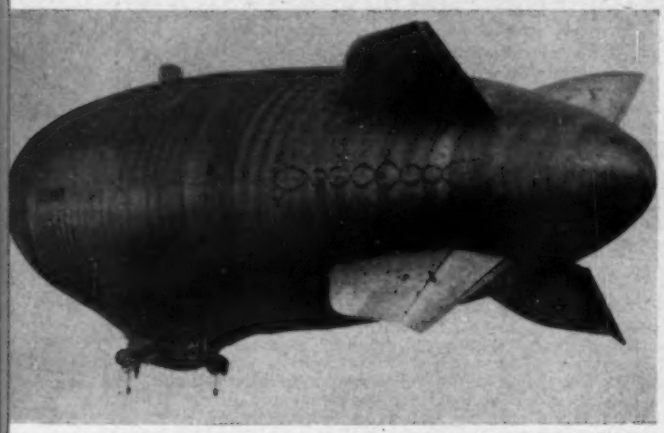
The underside of the fuselage behind the pilot should be kept clear to allow space for the varied loads to be carried. Generous ground clearance would allow under-belly equipment to be carried between a universal skid/wheel undercarriage of tubular construction. Specialized equipment should not be heavier than necessary and should be designed for quick detachability and easy maintenance. All metal parts would be treated with anti-chemical finishes. (Cellon have already carried out wide research into the problems of corrosion set up by the many agricultural chemicals.)

On the performance side, high speed would not be required; about 80 kt should be adequate. A payload of 1,200-1,400 lb would be a useful figure, allowing a coverage of about 80 acres for liquid spraying and about five acres for fertilizing with solids. If separate usages were adopted the payload required for a liquid-spraying aircraft would be lower than that for fertilizing operations, as the rate of application is lower. About two hours' fuel are required.

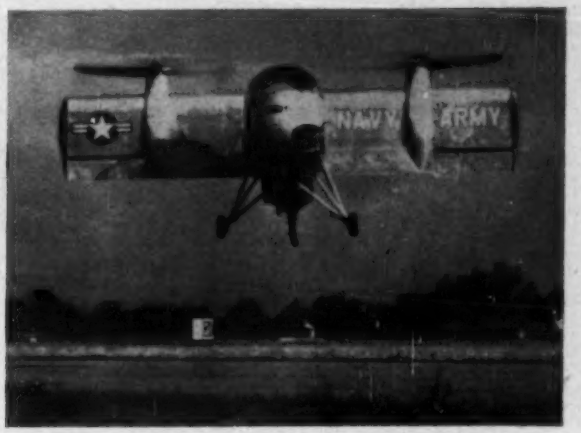
The writer would have suggested the use of tip ramjets on the score of utter simplicity; but whether this system would be sufficiently reliable under field conditions in agricultural work is debatable at the present time. The N.H.I. Kolibrie is a departure in this direction, and obviously there is a lot to be said for the simple design that results. The noise level may be against operational use in inhabited regions, especially in the United Kingdom.

The author of this article is a design consultant who has been studying agricultural-aircraft requirements for several years. Retained by Fison-Airwork, Ltd., as consultants in the development of the agricultural Chipmunk described in "Flight" for July 18, his firm designed the spray equipment, the windmill-driven pump of which is seen here.





DETECTION: Believed to have a volume of some 1½m cu ft (as against the 975,000 cu ft of the existing ZPG-2s) the Goodyear ZPG-3W made its first flight on July 21. Early warning is the ship's principal duty, and the envelope houses an enormous revolving search aerial.



TRANSITION: The Vertol 76 (U.S. Army designation, VZ-2) recently made a successful transition from vertical to forward flight, and is claimed to be the first tilt-wing aircraft to have done so. Gear-driven by a Lycoming T53, the rotors provide both lift and propulsion.

HERE AND THERE

Royal Reception

AIR cadets visiting the United Kingdom under an international exchange scheme—25 from the U.S., 25 from Canada and ten from European countries—were received with their officers by the Duke of Edinburgh at Buckingham Palace on July 21.

Finland's Swedish Trainers

A CONTRACT for 20 Saab-91D Safir piston-engined trainers for the Finnish Air Force was signed recently in Helsinki. The first aircraft are to be delivered at the end of this year and the remainder by the summer of 1959.

Navy Days

THIS year's Navy Days at Chatham—tomorrow (August 2) and August 3 and 4—will include aerobatics and mock attacks by F.A.A. aircraft, and some of the Royal Navy's latest guided missiles are being displayed.

Test-bed Princess?

ANNOUNCING the award of a contract to the Martin Co. of Baltimore for the study of "the whole problem of fitting an atomic powerplant into a sea-going aircraft," the U.S. Navy on July 21 confirmed their continued interest in adapting the airframe of the Saunders-Roe Princess for the first American nuclear-powered aircraft.

Lt-Gen. Chennault

FAMED as the wartime leader (as air adviser to Gen. Chiang Kai-Shek) of the "Flying Tigers," which were later absorbed into the U.S. 14th Air Force, Lt-Gen. Claire Lee Chennault died in New Orleans on July 27 at the age of 67. Among his many decorations was the C.B.E., and the R.A.F. issued a special order expressing admiration of his volunteer group's actions against the Japanese. He retired from the U.S.A.F. in 1945 and had latterly been chairman of Civil Air Transport, Inc.

U.S. Transport Purchases

WHEN the Minister of Supply was asked in Parliament on July 21 "to what extent it was now his Department's policy to purchase U.S. transport aircraft to supplement our defence requirements," Mr. Aubrey Jones replied that it remained the Ministry's policy to rely on British aircraft in all normal circumstances. "Where, however, requirements cannot be met economically from our own resources, we consider, of course, what our Allies have to offer."

High-altitude Ark

MANNED by two U.S. Navy balloonists, Cdr. Malcolm Ross and Cdr. (ret.) M. L. Lewis, a high-altitude balloon was launched near Crosby, Minn, on July 23. The purpose of the flight was to test equipment for two later ones (in November this year and early next year) which are to observe the atmosphere of Mars. The men were accompanied by about 5,000 insects, ranging from queen bees to house flies, to be used for determining the effect of cosmic radiation on future generations. They landed at Jamestown, North Dakota, on July 27 after staying aloft for 34 hr 43 min and reaching a height of 86,500ft.

Czech Helicopter Production

A BATCH of 200 HC-2 helicopters is being built by the Czech Moravan national enterprise for the home and export market. Developed by a team under J. Slechta, the HC-2, otherwise known as the Heli-Baby, was described in our "Helicopters of the World" issue dated March 21 last. A two-seater, it has a gross weight of 1,280 lb.

High School

TWENTY-FOUR pupils of Goole Grammar School were given flights by Blackburn and General Aircraft at Brough recently. This was the result of a promise made at the school speech day by Mr. Eric Turner, the company chairman, who said that those children giving the best answers to five questions should have free trips.

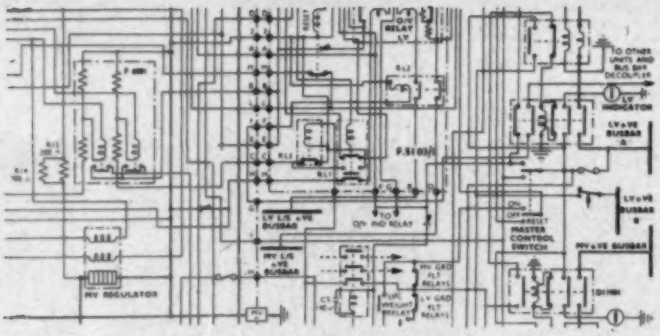
Nor Any Drop to . . . ?

WHEN his Auster ran out of fuel on a flight from Libya to Sicily during a violent storm Mr. Ronald Buxton, prospective Conservative candidate for Leyton, Essex, dropped a note in his shoe on the deck of a tanker and was rescued by its crew after he had had to ditch. Mr. Buxton, who was returning from a business trip to Kenya, had lost his bearings owing to the storm.

Cierva Essay Prize

ENTRANTS for this year's Cierva Memorial Prize essay competition are asked to write on *Is Man-powered Rotating-wing Flight a Future Possibility?* Competitors may be of any age or nationality; the prize is £50; essays must be in by December 31; and rules and entry forms may be obtained from the Honorary Secretary, Helicopter Association of Great Britain, 4 The Sanctuary, Westminster, London, S.W.1.

CONVERSION: The first two Hunter Two-seaters, ordered for conversion of Royal Netherlands Air Force pilots to operational jet flying, ready to leave Hawker's Dunsfold Airfield on July 18. Like the R.A.F. T.7s (see p. 168), these Hunters are based on the Mk 4.



Electrical Systems

AN AUTHOR RETURNS TO THE ATTACK

By LIONEL G. HILL, D.F.H.

MAY I be permitted to reply to criticisms and attacks on my recent article [*Flight*, May 2] on aircraft electrical systems. First, dealing with your anonymous contributor [May 23] and his reference to "red herrings" surely it is he, and not I, who is laying the fishy trail. I merely dealt with a statement of your previous contributor [January 24 and 31] on starter generators and gave an example of a recently designed circuit for a multiple starter generator system, which naturally included arrangements for equalizing as generators, to show the complications which arise. Can my challenger name any major aircraft, either single- or multi-engine, in full production during the past twenty years which uses a starter generator? I may be wrong but I have not heard of one.

In regard to brush wear, the "theory" is neither exclusively mine nor at variance with known facts. I think he and others are inclined to read into papers by Sims and his co-investigators finalities which are neither shared nor intended by their authors. Five years have elapsed since the Sims paper to which he refers was published. In 1954, at the Imperial College Vacation School, Mr. Sims said: "The almost universal employment of copper as a commutator material is not so readily understandable or defensible . . . there seems little doubt that it could be replaced with advantage by other materials such as the cupro-nickels." And, in regard to the low friction of graphite in the presence of water: ". . . it may be *assumed* that it is due to the adsorbed monomolecular film of water on the graphite surfaces." Why "assumed"? Why the doubt? Probably because Mr. Sims was well aware that the phenomenon of adsorption—the retention of fine films of water on the outer surfaces of materials as distinct from absorption, its retention between particles by capillary attraction—can only take place so long as the surface temperature of the material is not appreciably above that of the surrounding atmosphere, however moist. All tests show that the surface temperature of carbon brushes is, by a handsome margin.

I have not had the pleasure of meeting Mr. Sims but he and others make interesting references to plated copper and Monel commutators and their effect on brush and commutator wear. I feel that, in the light of these remarks, they would tend to share my opinions in a far greater degree than those of your contributor. In service there have been instances of brush life being extended by 200 per cent by skimming the commutator at service speed and tightening up bearing tolerances, a confirmation of the complaint made at the convention of poor production standards.

Of course, there is a commutation problem at high altitudes, but it also exists at low ones as well. Thirty years ago I worked in rotary sub-stations at an altitude no greater than that of Hendon when a "singing" commutator was recognized as a sign of deterioration of the protective film, to be cured by lightly rubbing the end of a paraffin wax candle over the surface of the "commy." The idea wasn't new even then and the candle was not known by the modern jargon of "adjuvants" or "anti-frets" but, as it is and was, a solid lubricant. I specified electrolytic copper for certain purposes in 1925 but I cannot say if it was used or even advisable for commutators but a change in the purity of a material is hardly a change in design. Let us leave it at that.

In regard to the comments by another speaker at the convention, we were both expressing opinions which happened to be opposite. Not unusual, of course, and time will show who was right.

I know that some hold the view that electronic equipment plays a negligible part in the electrical system. On a modern airliner radio and radar aids, autopilots and fuel measuring equipment together may amount to only a small part of the total electrical load but in importance to aircraft safety they are extremely large. The complexities which can and do arise and the troubles which occur in servicing from attempting to split these essentially single phase loads over three phases are the confirmation of my claim that single phase is the right system. Ask any aircraft radio man (he will also explain "cross-phasing").

I am glad that we agree on the matter of complexity—as if it were not self evident—but the confusion on real and reactive load sharing is his, not mine. I can assure him that the C.E.B. is most concerned about proper load-balancing across phases but it is the responsibility of the distribution sections and not the power stations to see that the single-phase loads are reasonably spread on all three phases so that the voltages on all three are within statutory limits. I speak from bitter experience, this having been one of my responsibilities as a mains engineer many years ago.

I emphatically disagree with his statement that it is possible for one alternator to supply all the kVAs and another all the kilowatts. Providing that they are running in parallel and are excited to the same output voltage (and, of course, have comparable synchronous impedances) they must and do share real and reactive loads inherently. Can it be that he is confusing an alternator with a synchronous condenser which is an *over*-excited synchronous motor?

Now for rectified A.C. At the convention at least one A.C. aircraft circuit incorporated a transductor which is the basis of a mag-amplifier and the proposed layout of the Britannia 300 was given. Compare this with the two previous Britannia circuits as published in Rotax handbooks in 1952 and 1955 and I think that he will find reason for my criticism. I dread to think what the next mark of this system will hold and to me an alternator incorporating two three-phase stators, one field rotor, three booster stators and one booster rotor is a horrifying beast for a main generating unit. Thank heavens it hasn't got an exciter as well.

By the way, I stand to be corrected, but wasn't it Vickers-Armstrongs who first put forward and developed the 112 volt system which was used in the Valiant and which was accepted and incorporated in the final specification of the M.o.S. for this aircraft?

Does his next statement need answering by anyone with experience of selenium, germanium and silicon rectifiers? As to constant-speed drives, what I have said is fact in so far as it refers to a hydro-mechanical torque converter drive but naturally does not apply to hydraulic or mechanical drives which may be considered as prime movers. This is now recognized by some in the States, where the hydro-mechanical drive was developed and I would refer to Dominic S. Toffolo's report on constant-speed drives issued by the Naval Research Laboratory in May 1956. Pneumatic and hydraulic drives are not in extensive use for reasons connected with the availability of bleed air from turbines or the long, vulnerable pipelines between pumps and hydraulic motors.

Now may I turn to Mr. Pilcher? [Correspondence, June 6.] I am most interested in his statement that "in all constant-speed mechanical or hydraulic drives a freewheel device is incorporated to prevent the alternator attempting to motor the engine." No mention was made of this at the convention, nor can I find any reference to this in past or present literature, British or American. If it is a recent addition, it confirms the point already made that the existing drives are not within the necessary limits of softness/stiffness for parallel operation, but I can see breakers ahead. If one engine falters (and piston engines do on frequent occasions) that alternator, falling behind the system, will be "freewheeled" into step by the remaining alternators as a motor. During this period, short as it may be, the full load will be transferred to the remaining alternators as it cannot generate and motor at the same time. In this way a severe load transient will occur on the system.

If, however, one alternator gets ahead, since a freewheel can only operate in one direction, it will attempt to motor the remaining three alternators into synchronism meanwhile taking the whole of the system load. Need I forecast what is likely to happen? In any case a freewheel capable of transmitting a 60kW load is no light weight and already the claim that three-phase A.C. systems are lighter than D.C. systems is shrinking to negligible proportions.

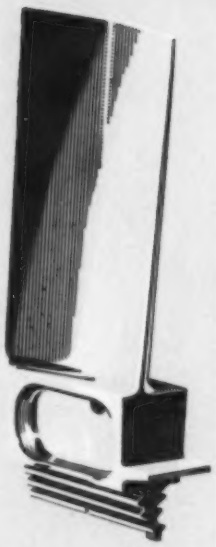
May I assure your correspondent that the confusion on load sharing is not my own? The governor receives only a single signal which has been compounded in a magnetic amplifier but the effect is the same. Let us take Finucane's statement on the subject in his symposium paper. ". . . control winding of No. 1 so biassing the drive governor to tend to *increase* speed. At the same time other machines *lose* speed momentarily thus restoring balance. The system frequency *does not actually change* during this process being held constant by the frequency discriminator circuits." But frequency is solidly linked with alternator speed, unless Mr. Finucane would have us believe that it can be the resultant of two alternators generating at different frequencies, so we have the peculiar state in that one machine increases speed while the other decreases speed yet both remain at the same speed.

Viscount Aircraft
of the Indian Airlines Corporation
and Indian Airforce

ROTOL PROPELLERS AND EQUIPMENT

Ground-running the starboard turbo-prop of the Napier Eland Convair medium-range airliner.

Reliability is the prime requirement of any engine destined to fly on the air routes of the world. In the British airliners which have pioneered turbine air travel—and in several foreign commercial aircraft also—gas turbines of British origin are setting new standards of long life and freedom from maintenance. Their impressive performance is due in no small measure to the choice of Nimonic Alloys for the turbine rotor blades and other vital parts operating at the top end of the temperature scale. These alloys are unique in being backed by more than 15 years' experience of aircraft gas-turbine blade problems.



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ELECTRICAL SYSTEMS . . .

It doesn't need technical knowledge but plain horse sense to deal with that argument. In any case, as Mr. Pilcher points out, the signal from the frequency discriminator system has already been incorporated in the signal to control the governor windings.

But, you will say, the system works. It does, but not because the load-sharing loop shares the load. That is already inherent in the system. It is a form of signal feedback to the governor, anticipating (instead of responding to) drive-load changes—as I said in my article. It is a stabilizing device which, like all such devices, tightens frequency control by reducing the response time constants of the governor/alternator/voltage-regulator combination. The term "load-sharing" was introduced by someone in America who "didn't know his onions" and has been swallowed, hook, line and sinker, by those with technical learning but limited A.C. experience in this country.

I wish that I could deal with other aspects of Mr. Pilcher's letter more fully, but space will not allow. There is nothing in my article to suggest that a Merz-Price system can detect out-of-balance between phase currents. He may be interested to know that I spent several years of early development on Merz-Price and other protective systems with Reyrolle and Co., and on their installation and adjustment, as mains engineer to the Northmet. Supply Co. I think that I may claim to have a rather more solid conception of these protective systems than your younger contributors.

I will deal shortly with Mr. Finucane. The theorizing is his, the experience—some thirty years of it in A.C. and D.C.—is mine. I will just take one more point from his paper, also on protection.

"The Merz-Price differential current protection system is used in the supply system in question. The neutral lead of each of the alternator phases is brought out and passed through a ring type current transformer. Another transformer is placed over each outgoing phase lead, the secondaries being connected in series opposition." He quite rightly states that protection only exists between the current transformers and then adds "the current transformers are so situated in the circuit that protection is provided against internal faults in the alternator *and in the main and synchronizing circuit breakers*." Either this cannot be true or the current transformers are *not* in the outgoing phase lead of the transformer. Mr. Finucane must learn to be more precise in his written statements.

It is well known that, in politics, when one is not sure of one's ground in an argument, it is always safe to switch the attack to the speaker. Your contributors and correspondents would be well advised to remember this and to deal with points raised on technical merits alone. Suggestions as to the possible lack of background, experience and knowledge of their opponents, of which they are usually totally ignorant, only discloses their own weakness in argument and throws doubts on their technical ability. I earned the right to call myself a chartered electrical engineer in January 1930 and ceased to do so a few years later, when I found that I was being judged on my experience and knowledge alone and not on the letters after my name.

I do not consider it my job to teach the younger generation what they are not anxious to learn. We can safely leave that to experience, a most uncompromising taskmaster, as I had to find. May I, though, give one word of advice? Vector diagrams and similar mathematical devices are most useful reminders to those who already have solid conceptions of what is going on in a circuit and this only experience can teach. They are awful snares to those without. Many of the vector diagrams I have seen postulate conditions which cannot possibly occur in practice and argument based on them is valueless at the outset.

Now, I have not said that A.C. or rectified A.C. systems will not work on aircraft. I have said that they are wrongly founded, unnecessarily complex and liable to excessive servicing troubles. Moreover, they do not give the advantages in weight-saving and other aspects claimed for them. I adhere to that. I have not been responsible for the decision to adopt any particular system for any particular aircraft, so I have none of those axes to grind. My only axe, a little but important one, is to see simpler, sounder, safer, lighter and more serviceable systems developed for aircraft.

A.C. and rectified A.C. systems are here and will remain with us for a time, for the momentum of a swing-over in general practice of this nature is too great to reverse without disastrous results on production. In time it will, I am certain, lose its energy and, as the shortcomings become more obvious, the reaction to the medium-voltage D.C./single-phase A.C. combination set in. I hope that this swing will start here and not in America for, as I said, we have the knowledge and ability to lead, not follow. There can be no question as to A.C. or rectified A.C. systems constituting a danger to aircraft. Responsible designers and airworthiness authorities can be relied upon to see to that. But the systems will bring a penalty to the operators in greater weight and complexity and extended periods of unserviceability as the aircraft get older. That, if you wish, is an opinion which time can safely be left to deal with.

One more point. Some, knowing my association with a particular aircraft company have, despite my clear opening statement, suggested that this might be a semi-official view. Once again I reiterate that the opinions, in so far as they are opinions, are my own—though I do not claim exclusive right to them—and the fundamental facts given are beyond dispute. The references were confined to the matters in the Convention papers and your earlier contributor's article and do not relate in any way to projects, current or proposed, by this or any other company. Any criticisms I might have of these are not for publication but for the exclusive ears of the engineers concerned.

Now I am fully aware that I have not dealt with all of the points raised, but I feel that I am already overstaying my welcome on these pages. I can only hope that the editorial blue pencil will not be too heavily used.

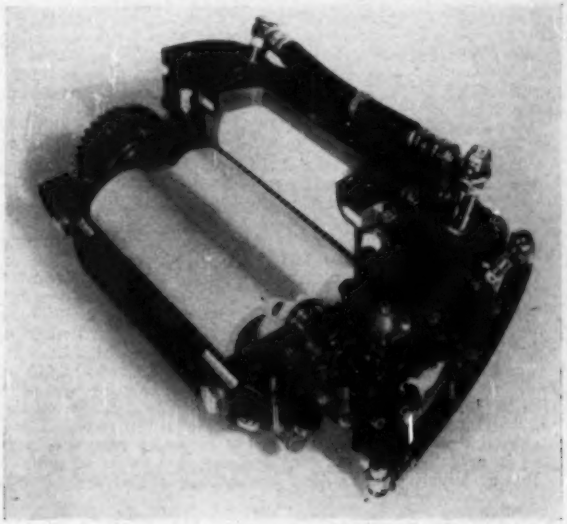
CABIN BLOWER DEVELOPMENT

THE introduction of pressurized aircraft some twenty years ago was necessarily preceded by the design and manufacture of lightweight cabin superchargers capable of supplying high volume airflows at relatively low pressures. Requirements of this nature inevitably precluded the use of reciprocating compressors but were particularly favourable to positive-displacement rotary compressors and continuous-flow compressors of the centrifugal or axial type.

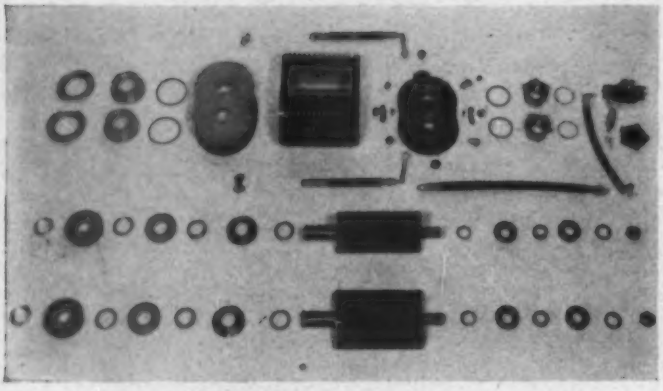
From the beginning, American users have favoured the centrifugal compressor, whereas British practice has, until recently, been based almost exclusively on positive-displacement Roots-type compressors, as exemplified by the Type 15 made by Sir George Godfrey and Partners, Ltd.

Since the introduction of turbine-engined transport it has been a common practice to tap the engine compressor for pressurization air. Recently however there has been some change of attitude, particularly in America, and the current trend for civil applications is once more toward a separate compressor. On the Viscount, and indeed on all transport aircraft so far powered by the Rolls-Royce Dart, Godfrey Type 15 blowers are standard equipment.

Godfreys produced a Roots-type cabin supercharger early in 1938 to meet a requirement for a high-altitude aircraft. During the war large numbers were produced. After the war attention was directed to the requirements of civil aviation and the company produced a variety of types, both single- and two-stage. Of these, the Type 15 has earned an excellent reputation for reliability. Many hundreds are in service in Viscount, Ambassador, North Star and Argonaut installations. They are also in production for both the Fokker and the Fairchild Friendship, the Handley Page Herald and the Grumman Gulfstream, and will be installed in the A.W.A. Argosy. [*Contd. overleaf*



A Godfrey Type 15 cabin blower displayed in part section.



Type 15 cabin blower dismantled to show simple construction.

CABIN SUPERCHARGERS . . .

When, in 1950, T.C.A. converted the pressurization systems of their DC-4M2 North Stars aircraft by installing the Type 15 in place of the original centrifugal compressor of American manufacture, they achieved a weight saving of 230 lb and predicted a saving of nearly half a million dollars a year in overhaul costs alone. The claims made for the new blower, state Godfreys, were quickly substantiated and it was found that the initial period of 1,600 hours between overhauls was even then some 1,100 hours better than for the equipment superseded. The period between overhauls is now officially approved at 2,400 to 3,500 hours, depending on the particular aircraft and operator concerned.

In 1950 the Type 15 set new standards for a Roots-type blower by giving its rated output at 12,000 r.p.m. In the eight years that have since elapsed the maximum speed has risen to 15,000 r.p.m. and the maximum delivery pressure to 15 lb/sq in. Volumetric flows up to 1,000 cu ft/min are possible, and pressure ratios up to 2.5.

The ability of the Type 15 to accept increasingly severe performance requirements is particularly marked in the Viscount installation, where increased flows and pressures have been made available, yet with a continued increase in the period between overhauls.

For installations in which high performance must go hand in hand with high adiabatic efficiencies the company is developing a screw-type compressor under licence from the Swedish firm Svenska Rotor Maskiner. A large, high-capacity cabin supercharger, the Godfrey/SRM Type 175, is now in production for the Vickers Vanguard and the Canadair CL-44. Compressors of this type are stated to be particularly suitable for use in both air-cycle and vapour-cycle refrigeration systems, and the company is at the moment manufacturing complete Freon systems for two British aircraft.

Godfreys have always operated a comprehensive repair and service organization, many operators preferring not to undertake such work themselves. An exchange repair scheme is also available. The fundamental simplicity of the Godfrey-manufactured Roots and SRM machines is deceptive in that it belies the high standard of detail design and the precision machining which make possible their high-performance characteristics. The test rigs and workshop tools required for overhaul are relatively cheap, and the standard of skill required is well within the capabilities of the average mechanic.

THE ROUTING PROCESS

INDICATIVE of the trend towards the segregation of specialized technology and processes is the establishment of Routing, Ltd. As the name implies, this firm specializes in the production of metal components by high-speed machining, and it is believed to be the only firm engaged exclusively in this process. Routing is an associate company of Morfax, Ltd., Willow Lane, Mitcham. It developed from the original routing department of the parent company, where for some four years routing development and tooling have been in progress.

The new factory, situated at Faggs Road, Feltham, Middx., is at present equipped with some twenty Wadkin routers, including three fitted with 20 h.p. heads and one with hydraulic depth-control. Nine more machines are due for delivery within the next two months. There are in addition special-purpose machines, including a twin-operator skin-mill capable of handling plates 6ft in width to an unlimited length. Supporting this installation are machines to handle tooling and templates manufactured for the production line, including Victoria and Wadkin mills; Smart and Brown and Colchester lathes; Jones and Shipman tool and cutter grinders; Bohner and Koehle boring machine (with Hilger and Watts optical setting); and a V.36 DoAll bandsaw and filing machine. Blending and finishing equipment includes rumbling plants of various sizes and a Vacublast installation. The whole organization is adequately covered by a well-set-up inspection department.

A new building, of some 18,000 sq ft, is being erected at the rear of the existing premises. It should be ready early in September, and will permit the expansion of plant and facilities warranted by existing production commitments. Routing, Ltd., is to develop as an entirely independent concern. The parent company—who have retained an experimental department at Mitcham—have received a M.o.S. contract to investigate the application to routing of titanium and high-tensile steels.

As sub-contractors to a number of leading aircraft firms, Morfax received requests for the economic production of experimental components machined from the solid in new alloys. In 1953 the company decided to investigate the possibility of improving the routing process and an experimental shop was set up at Mitcham.

At about this time Vickers-Armstrongs (Aircraft), Ltd., at South Marston, had succeeded in rough-cutting spars from solid billet. The deeper cuts were obtained by successive passes and the final machining was made on expensive Hydrotels. These imported machines, whilst giving the necessary accuracy, were slow in operation and therefore uneconomical in production.

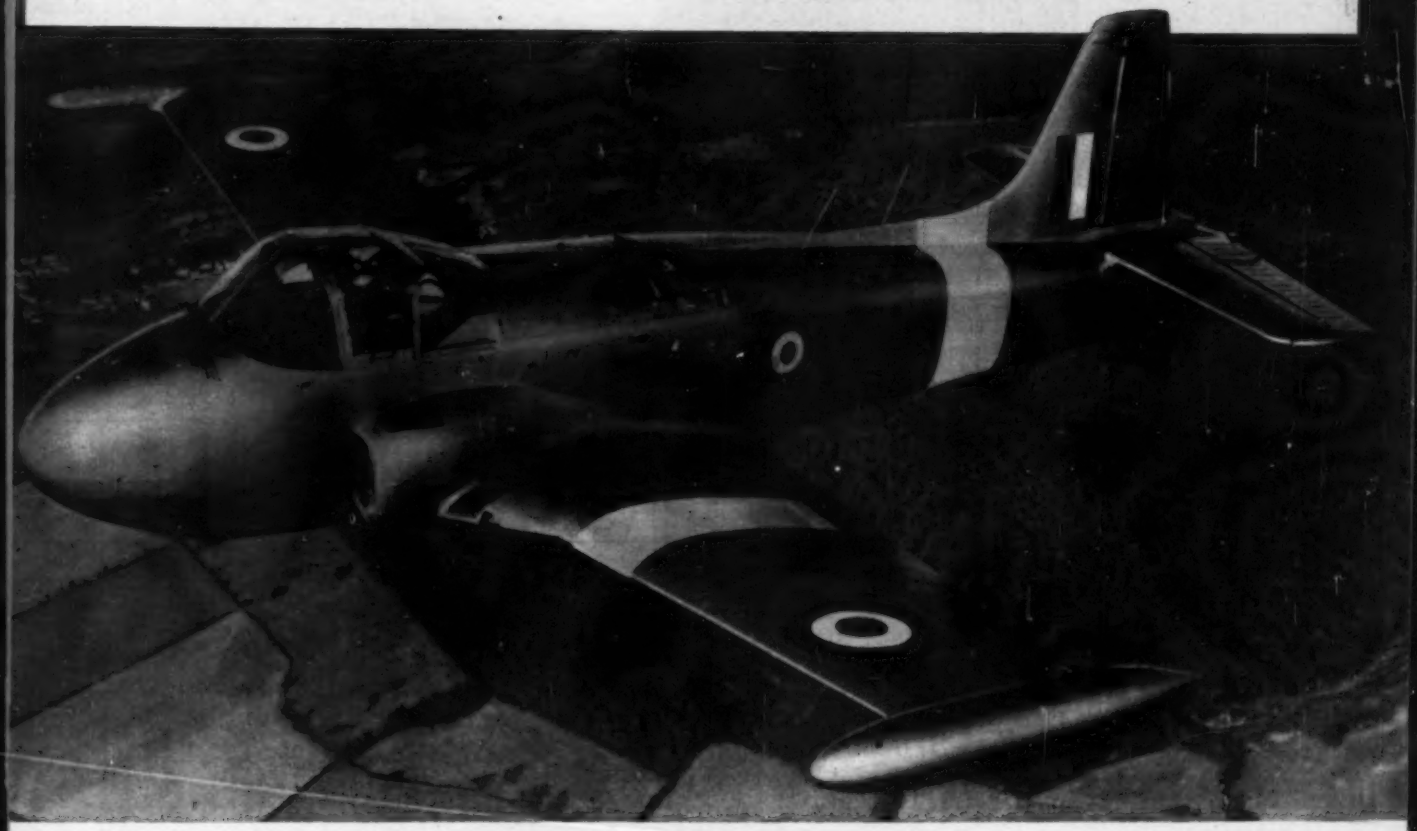
It was largely due to these circumstances that interest was centred round the improvements of the routing process. For their part, Morfax set about increasing depth of cut per pass, and they produced a cutter which successfully cut a depth of 3in in light alloy. Close liaison was established with Wadkin, Ltd., and this eventually produced equipment capable of cutting to a depth of 6in or more. The Morfax experimental team produced special cutters and Wadkin stepped up the power of the driving head.

Morfax next turned their efforts towards improving accuracy, by a combination of cutter-guide and template modification together with further studies of cutter design. Success eventually led to the production of form tools, and the variety and scope of the improved process enabled the routing department to undertake production runs in addition to prototype work. Wadkin concurrently produced more robust and versatile equipment which enhanced both accuracy and efficiency.

Sheets measuring 12ft × 4ft have been routed from their original thickness of just over 0.25in to 0.080in over the thinnest areas. Other skins have been reduced from the same thickness to 0.023in, which demonstrates the degree of control now possible.

Typical of the current work of Routing, Ltd., is this bulkhead—possibly for the Victor B.2—in high-tensile aluminium alloy. The original billet weighed 23 cwt and the finished product 8¾ cwt.

In service with the Royal Air Force



Two years service with the Royal Air Force has established the Jet Provost ab initio/basic trainer as the best aircraft for its purpose, and the Mk3 is now in production for the re-equipment of Flying Training Command.

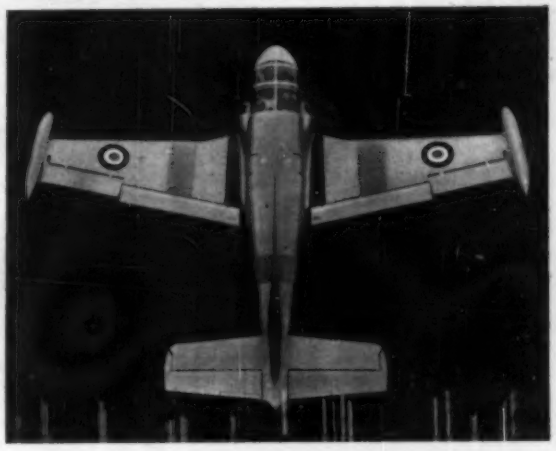
Improvements over the Mk1 include a redesigned undercarriage and windshield, a later mark Viper engine of increased power, increased fuel capacity and the installation of ejection seats.

Jet Provost

Powered by one Armstrong Siddeley Viper Turbo Jet.

The Jet Provost can be supplied to overseas air forces with or without ejection seats and can also be equipped with armament—machine guns, bombs and rockets—for use as a weapons trainer or as a tactical weapon.

Take-off distance, to clear a 50′ (15 m) obstacle...1990′ (606 m)
Climb:
Sea level to 10,000′ (3048 m) ... ... 5.0 mins.
Sea level to 30,000′ (9144 m) ... ... 23.0 mins.
Rate of climb at sea level ... ... 2380 ft./min. (12.2 m/sec.)
Max. level speed at 30,000′ (9144 m)...286 knots (530 km/hr)
Range (with tip tanks) ... ... 490 n. miles (910 km)
Endurance ... ... 2.45 hrs.



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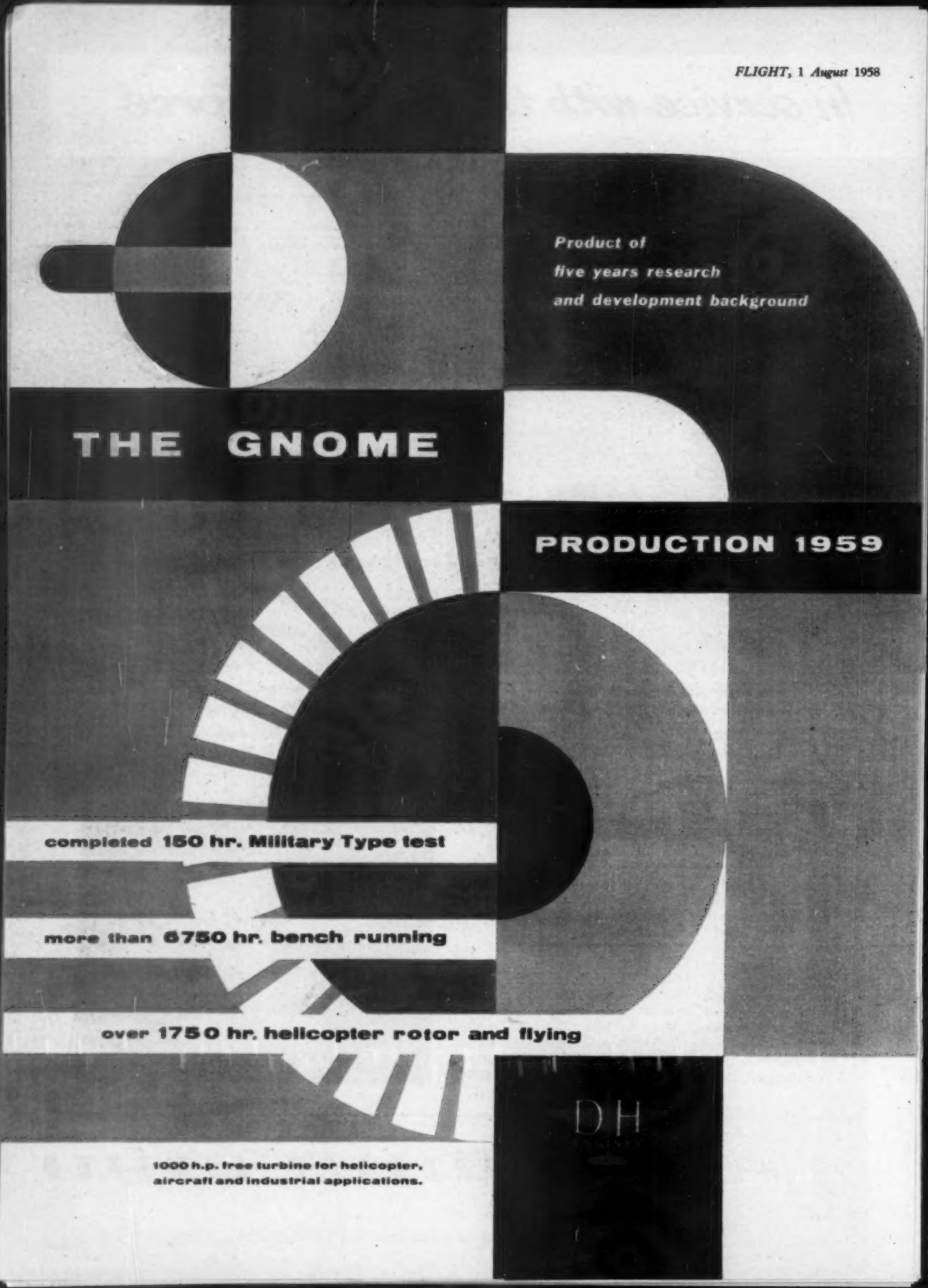
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Training the Naval Fighter Pilot

METHODS AT R.N.A.S. LOSSIEMOUTH

BY A. CECIL HAMPSHIRE

SITUATED on the south shore of the Moray Firth, Royal Naval Air Station Lossiemouth enjoys the best weather factor (0.8) of any airfield in Britain. That it should do so is important, for H.M.S. *Fulmar*, to give the station its ship name, is the Fleet Air Arm's fighter training school, and good all-the-year-round flying conditions are essential.

Constructed less than a mile to the west of the little fishing port of Lossiemouth, the airfield was first opened in 1938 by the R.A.F., and used throughout World War II by aircraft of Bomber Command. In 1946, after the R.A.F. had relinquished possession, the station was taken over by the Navy and commissioned as H.M.S. *Fulmar* for use as an additional operational flying school for the Fleet Air Arm.

In February 1950 the Naval Air Fighter School was established at Culdrose, in Cornwall, absorbing in the process the old School of Naval Air Warfare, which had formerly functioned at St. Merryn, and the Fleet Air Arm's No. 2 Operational Flying School from Eglinton.

In 1953, combined as the Naval Air Fighter and Strike School, the establishment was transferred to Lossiemouth.

The main task of the school today is the preparation of Naval aviators to take their place in front-line fighter squadrons. Fleet Air Arm fighter training falls into two categories: intercepter day fighter and all-weather. After obtaining their wings at the R.A.F. flying training school at Linton-on-Ouse, Naval pilots in the making who are allotted to fighters move on to Lossiemouth for operational conversion to front-line standard in either I.D.F. or A.W. Selection for the latter category, which is slightly less than half the total annual intake, is made at the Admiralty.

Three second-line squadrons, Nos. 736, 738 and 764, are permanently resident at Lossiemouth for instructional purposes. No. 736 is equipped with Sea Hawks and Sea Vampire T.22s; 738 has Sea Hawks and Sea Venoms; and 764 has Sea Hawks only. The Vampires are to be replaced by Hunter T.8s in the near future, while 764 Squadron will be getting Scimitars in lieu of their Sea Hawks. Each squadron maintains a strength of about 15 aircraft. Four target-towing Meteors are also attached to the station.

Commanded by Lt-Cdr. L. E. A. Chester-Lawrence, 736 Squadron has a complement of ten pilots. Five are qualified flying instructors (two A2 and three B1), and four are tactical instructors. One of the Q.F.I.s is also an air warfare instructor, and two others are instrument grading examiners. The C.O. flies as an instructor with the rest of his staff.

The principal task of 736 is the introduction of the I.D.F. entries from Linton to their first operational aircraft. This part of the full fighter training course of 21 weeks carried out in Sea Hawks, totals 50 flying hours. The curriculum comprises the general handling of aircraft, formation flying, air-to-air ciné-gunnery exercises, navigation and night flying.

Additional tasks which fall to the lot of 736 are the conversion of American-trained (NATO) pilots to British techniques; dual continuation training of operational flying school and American-trained students; jet conversion courses and refresher flying; dual continuation of first and second-line pilots; forward Army air controllers' courses; and Fleet Air Arm acquaintance courses for officers undergoing the long gunnery course. Operational jet conversion students are given a shortened O.F.S. course of 24 flying hours in Sea Hawks to convert them to British methods and techniques, but this is preceded by 25 hours flying sorties in Vampires with the accent on instrument flying.

Captain F. M. A. Torrens-Spence, D.S.O., D.S.C., A.F.C., R.N., who commands the Naval Air Fighter and Strike School at Lossiemouth.

One of No. 803 Squadron's Scimitars coming in to land at Lossiemouth in characteristic nose-up attitude. The Scimitar has blown flaps.

Following completion of the first half of the course in 736 Squadron, the I.D.F. pupils pass on to 738 Squadron, which is regarded as the "finishing school" for all Fleet Air Arm student fighter pilots. Commanded by Lt-Cdr. R. J. McCandless, 738's instructional staff consists of four tactical instructors, including one R.A.F. pilot, in addition to the C.O. and senior pilot. All are experienced fighter pilots who have completed a number of tours in front-line squadrons. In fact, the combined total of fighter squadrons in which 738's instructors have served is 20—a figure which includes almost all the day fighter squadrons and several night and all-weather squadrons of the Fleet Air Arm.

While the intercepter students have been undergoing the first half of their course in 736 Squadron, the all-weather trainees have received similar tuition on Sea Venoms in 738. They are then joined by their intercepter brethren for the second half of the course.

Part 2 totals 45 flying hours, and includes rocket-firing, dive-bombing and low-level strafing; fighter combat, using a nylon banner target towed by a Meteor, the pupils being required to carry out 40-50 dummy approaches at high and low levels; high-speed interception; air-to-air firing; army support exercises; photographic reconnaissance; and advanced night formation flying. The students also carry out navigation flights and other sorties designed to familiarize them thoroughly with their aircraft.

Since both the Supermarine Scimitar and the de Havilland Sea Vixen—when the latter comes into service—are capable of carrying the atomic bomb, new bombing techniques are shortly to be added to the curriculum at Lossiemouth.

In conjunction with the flying training a comprehensive ground-school syllabus is taught, designed to give the students a thorough knowledge of their aircraft and its tactical uses. The lectures include air traffic control, meteorology, high-speed flight, high-level navigation, action information organization, communications, armament, tactics and army support.

The teaching of the last named is the province of the C.B.G.L.O. (carrier-borne ground liaison officer), at Lossiemouth a major of the Royal Scots. The presence of liaison sections in aircraft-carriers and at Naval air stations today is indicative of the close inter-Service co-operation necessary to the performance of the

A Sea Hawk belonging to the German squadron being serviced by German groundcrew. Note the Federal German Navy anchor insignia.

TRAINING THE NAVAL FIGHTER PILOT . . .

Navy's rôle of mobile task force. The syllabus includes tactical air reconnaissance, photography, air control team exercises and controlled ground attack by strike aircraft. At Lossiemouth the Army officer adds realism to the exercises by taking out a suitcase of "tanks" made of rubber, which he inflates and disposes strategically about the exercise area. A number of disused wartime airfields also play a useful part in this phase of Naval fighter-pilot training.

On the air engineering side concentrated instruction is given on both the Sea Hawk (Nene) and Sea Venom (Ghost). This part of the course is in two phases. Phase 1 covers the function, construction and operation of the engine, airframe, electrical and radio installations; Phase 2 the routine inspection of aircraft up to primary inspection standards in the A, E, and L trades. An examination is held at the end of each phase, the results of Phase 1 counting towards the student's final pass. On successful completion of Phase 2 each pilot is awarded a certificate of qualification in first-line servicing of aircraft.

Each of the training squadrons has its own hangar with briefing, crew and analysis rooms, the latter equipped with wall charts on which are recorded the progress of the students and the results of the various exercises. Ciné assessment is carried out by Wren ratings, who also provide a proportion of each squadron's quota of pilot's mates, air mechanics and air radio mechanics. No. 736 Squadron uses for a simulator the cockpit of a pranged Sea Hawk. Numbered 654 in its flying days, this useful remnant now bears the appropriate number seen in the photograph below.

The station controls a satellite airfield at Milltown, some eight miles to the west, which is equipped with a complete mirror landing installation, and here all "Maddls" (mirror aerodrome dummy deck landings) are carried out. Here is also an extensive site for the permanent parking of caravans belonging to officers and ratings who prefer a home on wheels to married quarters. The C.O. of 738 Squadron, himself a confirmed and enthusiastic van-dweller, doubles up as O.C. Caravans.

Lossiemouth is also provided with a number of first-class ranges for rocket firings, bombing and strafing, which extend from Fraserburgh in the east to Tain in the west. As the station is close to the sea (a conveniently placed 18-hole golf course stretches between the perimeter fence and the shore) the ranges can be reached without loss of time and fuel; exercises can, in fact, begin within three minutes of leaving the runway. Air interception training is conducted with the aid of the Royal Air Force G.C.I. station near Peterhead.

No. 764 Squadron, the third of the instructional trio at H.M.S. *Fulmar*, is concerned with the training of air warfare instructors. One A.W.I. serves as a pilot member of each front-line fighter squadron in the specialist capacity of adviser on weapon training and the selection of weapons for various targets. The squadron also provides refresher courses in ground attack and air combat for squadron commanders designate.

A.W.I. candidates are pilots of lieutenant's rank who must have performed at least one tour of duty in a front-line squadron. After undergoing a course of four weeks' ground instruction on weapon theory in H.M.S. *Excellent*, the Navy's gunnery school, the students do ten week's flying at Lossiemouth. All aspects of weapon delivery are taught—rocketing, bombing, strafing and air-to-air firing—together with ground attack and air fighting tactics. One week of the course is devoted to ground attacks at night. Divisional attacks and briefing, and exercises in leading a maximum number of aircraft available in strikes, are also included in the syllabus.

Side by side with the flying training the A.W.I. course includes a comprehensive ground instructional programme. Pupils are made familiar with the component parts and stripping of all conventional weapons, and the theory of air-to-ground and air-to-air fighting. There are three A.W.I. courses annually, each averaging 15 pupils.

Squadron commanders designate—usually lieutenant-commanders or senior lieutenants—undergo a modified form of the A.W.I. course, which lasts six weeks. Here the accent is on leadership in the air, and the standardization of operational techniques within the Fleet Air Arm. Ground instruction includes lectures by specialist officers on subjects of particular application to squadron commanders, such as organization, administration, correspondence and stores.

Other tasks carried out by 764 Squadron are "flaps"—front line armament practices—for the first-line squadrons who come to Lossiemouth to work up; refresher courses in fighter and weapon training for pilots who are returning to front-line service after a spell of sea time or detachment from flying duties—there is usually a floating population of at least three of these; the maintenance and flying on a limited basis of a small pool of young pilots awaiting appointment to front-line squadrons after completing their operational flying training; and the provision of a comprehensive ground syllabus on air weapon subjects and the various forms of Fleet Air Arm air-to-air and air-to-ground attack for General Service officers undergoing long gunnery courses.

No. 764 is also parenting the German Sea Hawk *Staffel*, which is one of the first two Sea Hawk squadrons composing the newly

(Left) Wren air radio mechanics checking electronic equipment in a Sea Hawk at Lossiemouth.

(Centre) No. 736 Squadron's ground trainer is the cockpit of a no-longer-airworthy Sea Hawk.

(Right) As now worn: a Lossiemouth pilot is issued with flying kit by W.R.N.S. stores personnel.

formed air arm of the Federal German Navy. To the writer it seemed strange to see, in a Fleet Air Arm hangar, aircraft bearing the characteristic German black cross and red-yellow-black flag. A black anchor—the Federal German Navy marking—is painted on the fuselage, together with a rabbit, which appears to be the squadron insignia, but repeated questionings failed to elicit the origin or significance of this emblem.

The commander of the German squadron, stocky Korvetten Kapitan P. Jung, is 41 years old—considerably over age by British standards. A former Luftwaffe pilot flying Me109s, Jung was shot down over Crete in 1941 and spent the rest of the war as a p.o.w. in Australia.

The *Staffel* has a strength of 12 aircraft, with eight pilots—most of them too young to have served in the war—an air engineer officer, and its own ground crew. Initial pilot training was given at Pensacola, in the United States, on Grumman Panthers. On arrival at Lossiemouth for conversion on to Sea Hawks the Germans joined 736 Squadron and underwent a course similar to that given to British students.

But weather conditions in this country—even at Lossiemouth—are very different from those of Florida and the Germans had to be given 25 hours on Sea Vampires, mostly on instrument flying, to enable them to obtain an Instrument Grading Certificate. This was followed by 25 hours on their own Sea Hawks, the curriculum including general aircraft handling and tactical flying. No weapon training was given, however, the Germans carrying out their own programme under the parentage of 764 Squadron.

The *Staffel*, which includes one British pilot for liaison duties, will shortly be leaving for Germany. More German intakes are expected next year under NATO co-operative policy, but these students will do all their flying training in this country, beginning at Linton and continuing with the full fighter syllabus at Lossiemouth.

In addition to its main function as the Naval Air Fighter and Strike School, Lossiemouth is also the parent station for three front-line squadrons doing their own working-up exercises prior to joining carriers. One of these, No. 803, was re-formed at Lossiemouth early in June with F.Mk 1 Scimitars. Their work-up period, mainly devoted to applied weapon training, will last until the end of August, when the squadron is due to join H.M.S. *Victorious*. Each pilot is expected to fly 100 hours during the work-up, including the time spent in 700X Flight. (Formerly all evaluation trials of new aircraft coming into squadron service were carried out at R.N.A.S. Ford by No. 700 Squadron, known as the Trials and Requirements Unit. Commencing with the Scimitars, however, future evaluation trials will be conducted by pilots from squadrons who are to re-form with the new aircraft they will be testing, under the temporary unit-number 700X.)

To mark the introduction of the Navy's first swept-wing aircraft those members of 803 Squadron who participated in the trials of the new aircraft now sport a special tie, the design of which consists appropriately of scimitars on a Navy-blue ground.

The pilots are full of enthusiasm about their new aircraft, which they maintain has the highest performance of any in British service today. As a counter to such encomiums the ground personnel at Lossiemouth consider the Scimitar to be the noisiest aircraft they have yet been called upon to handle.

Following the recent decision to concentrate the tasks of Home Air Command in larger groups at fewer bases, which has resulted in the closing of a number of stations, an Aircraft Holding Unit is now stationed at Lossiemouth. The task of the unit, which deals with all-weather and strike aircraft and came from the R.N.A.S. Stretton, is to receive new or re-worked aircraft from the contractors' works or Naval aircraft yard and check and equip them for Service use; inspect, rectify and modify aircraft returned from user units; modernize certain types of aircraft; hold aircraft in a suitable state of preservation when not required for immediate use; and to retain aircraft which have been written off charge pending disposal.

At present the unit holds about 320 aircraft, of which 140 are in use. These include Dominies, Sea Princes, Sea Devons, Balliols, Meteors and Vampires. Among other types awaiting disposal are a number of Wyverns and Seamews. The unit's maintenance test pilot checks all aircraft received, and will shortly be test-flying the Hunter T.8, due to replace 736 Squadron's Sea Vampires. While the Fighter School comes under the jurisdiction of the Flag Officer Flying Training, the Holding Unit remains the responsibility of the Flag Officer Reserve Aircraft.

As with other Naval air stations, Lossiemouth has a resident helicopter search-and-rescue section, equipped in this instance with three Dragonflies. All are fitted with a rescue winch and ten-channel V.H.F. radio, and the section has a full set of rescue gear. There are three pilots, three aircrewmen and nine maintenance crew.

The section's chief task is to provide a speedy rescue service for crashed aviators, and this entails intensive training with the station squadrons, local ships and lifeboats. There are also frequent calls for emergency rescue work unconnected with aviation, and for transporting urgent medical cases to hospital. In 1956 Lossiemouth's helicopter unit was awarded the Boyd Trophy for its part in the rescue of the crew of the Norwegian steamship *Dovrefjell*.

To avoid confusion during lost-aircraft searches the station operations room maintains an aircraft wreck chart, and has established a "rapid-search p'an" which obviates lengthy briefing of the helicopter pilots in the early stages of search for a missing aircraft. Fuel dumps are also established at various points throughout the countryside for the use of helicopters on extended operations.

A motor fishing vessel is attached to the station, mainly for the purpose of exercising aircrew in wet dinghy drill. At Lossiemouth this is the province of a 3rd Officer, W.R.N.S., who is the safety-equipment officer. All students and station aircrew undergo wet and dry dinghy drill, dry winching, and instruction in the use of the ejection seat, the station possessing its own rig for this purpose.

Pinned up on the walls of hangars, offices and classrooms are a number of illustrated flight-safety posters known as "Lossie Mouses." This is an adaptation of American practice, whereby anyone guilty of carelessness or an error of judgment notes down the brief details of his slip, signing himself "Any Mouse"—a play on the word "anonymous." These confessions are passed to a senior pilot designated as the flight safety officer, who thereupon, with the aid of an eye-catching sketch, draws up an appropriate safety reminder for the benefit of others on the station. One such "Lossie Mouse" noted by this writer was headed "Suspect Engines Should be put u/s," the culprit having been a Dominie pilot who took up his aircraft despite an oil leak (he saved his neck only by making a "dirty dive" on Lossiemouth's runway—which, incidentally, at 3,000 yards is one of the longest in the country).

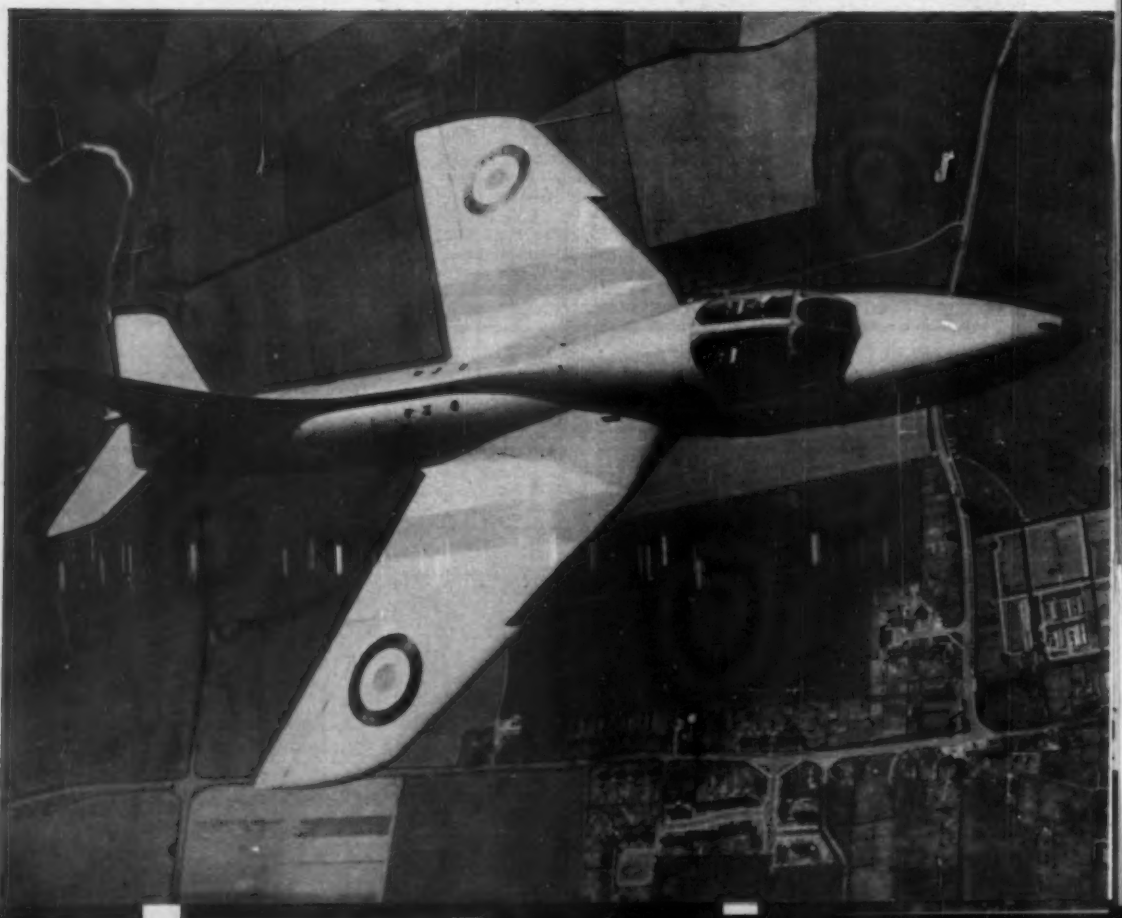
The station offers plenty of off-duty diversions for students and instructional staff, which include some enviable salmon fishing (through the courtesy of local lairds), shooting, sailing and golf. As the Cairngorms can be reached within two hours some first-class mountaineering and (in winter) ski-ing are available almost at the back door. The station also boasts its own riding club, with six hacks.

The present commanding officer of H.M.S. *Fulmar* is Captain F. M. A. Torrens-Spence, D.S.O., D.S.C., A.F.C., R.N., who as a Swordfish pilot participated in the famous Fleet Air Arm raid on Taranto in 1940. It is a far cry from the "Stringbag" to the Scimitar, but the standard of efficiency as exemplified in the Naval Fighter School is as high today as it was when a handful of Naval airmen put an enemy battle-fleet out of action in its own defended harbour.

Instructors of No. 736 Sqn. with some of their "Hawks" in the background.

REVERSE AND OBVERSE

. . . views of a production Hawker Hunter T.7 for the R.A.F. These Hunters are basically Mk 4s, with four-figure-thrust Rolls-Royce Avons. Certain export models, however (Hunter Two-Seaters have been ordered for Holland, Denmark and India) will have the five-figure-thrust 200-series Avon. Two-Seaters are also on order for the Royal Navy under the designation T.8



BRISTOL 192

EUROPE'S LARGEST MILITARY HELICOPTER

ON July 5 the Bristol 192, the largest military helicopter yet produced in Europe, made a successful first flight at the manufacturer's airfield at Weston-super-Mare. This first machine is a prototype only in a limited sense since it was built in production jigs and is already being followed by the remainder of the batch ordered for the Royal Air Force. The second machine should fly later this year; and deliveries will follow shortly thereafter.

With a gross weight of 18,000 lb and a powerplant of two Napier Gazelle NGa.2s, the 192 has full twin-engined capability and can fly continuously on one engine. The free-turbine drive eliminates the need for freewheel and clutches, and offers considerable advantages in operating flexibility. Being particularly designed for helicopter applications, the Gazelle may be run at a continuous power well below its maximum output without incurring undue penalties in efficiency and specific fuel-consumption. In the Bristol 192 the Gazelle is normally limited to a continuous power of 920 s.h.p., with a one-hour rating of 1,300 s.h.p.; and for 2½ min this may be increased to no less than 1,650 s.h.p. Performance figures are listed in the data panel on the following page.

Though designed for use by the R.A.F. in the general-purpose rôle, the 192 can equally well be adapted for anti-submarine work and other specialist duties. In this respect the wide c.g. travel allowed by the tandem-rotor layout is a particularly important feature. Bristol claim that this configuration also offers better stability and control than does a single lifting rotor. The latter type, in any case, they consider as a twin-rotor machine with one rotor countering torque and contributing nothing to lift.

Types of mission for which provision is already made in the 192 include communications, freight, ambulance, supply and paratroop dropping, search and rescue, submarine search and ferrying.

The normal seating capacity for communications is 18, the seats being disposed against the fuselage walls and arranged to fold. Additional seats can be added to carry a total of 22 passengers; and a scrambling net can be attached to the sill of the main door to facilitate rapid entry and exit. The floor is stressed for loading freight at 75 lb/sq ft; and 6,000 lb may be distributed in the cabin. The main door, which may be of light alloy or canvas, measures 50in wide by 54in high and can be replaced by a stressed door carrying a hydraulic or electric winch capable of lifting 600 lb at a time. Awkward loads weighing up to 5,250 lb may be slung from an under-fuselage strong-point fitted with pilot-operated mechanical and electrical release gear.

Either eight or twelve stretchers and two sitting patients can be carried, together with an an attendant, medical stores, blood-transfusion equipment and four electrically heated blankets. A static line may be fitted for paratrooping and there is room for 12 fully equipped paratroopers or stores. For rescue purposes a Sarah receiver and low-level radio altimeter would be installed and ten or more rescued persons, depending on the range required, could be accommodated. A searchlight would also be attached to the winch-carrying door—in addition to the two retractable landing lights permanently fitted beneath the cockpit. A plastic drip-tray would be positioned near the door to collect water dripping from survivors and prevent it entering the underfloor structure. For submarine search, "dunking" sonar equipment would be mounted in racks in the main cabin, the winch cable passing through the floor.

Two 260 Imp. gal extra tanks may be mounted in the cabin to provide a ferrying range of 625 nautical miles with a 20 per cent reserve and a further allowance for landing and take-off. Total fuel load would then be 1,080 Imp. gal. The addition of one of these tanks would offer a range, with the same reserves, of 498 n.m.

The Type 192 is born of the line of Bristol tandem-rotor, twin-engined helicopters, designed and built under the direction of Raoul Hafner since World War 2. Drawings of the piston-engined Type 173 were first issued in 1948 and a number of these aircraft have been flying since 1952. Initially the 173 might have been called a double Sycamore, using rotors and hubs similar to those of the Sycamore, similar rotor controls, two Alvis Leonides engines and cockpit frames identical with those of the earlier machine. Ground-running began on May 5, 1951, and tethered flights in November of that year. The first free flight was made on January 3, 1952, but the prototype was damaged when ground resonance was encountered on touchdown after its second flight. It was repaired and flew again in July after an intensive study of its resonating characteristics which led to a modification inter-connecting the oleos of each undercarriage; and it appeared at the S.B.A.C. Display at Farnborough that year.

A second prototype, designated 173 Mk 2, was built with

1 Yaw pedals
2 Cyclic-pitch control
3 Collective-pitch control
4 Hydraulic hand-pump
5 Throttles (ground running)
6 Engine starting panel
7 Longitudinal trim
8 Retractable landing lights
9 Rotor brake
10 Rotor synchronizing shaft
11 Synchronizing shaft bearing
12 Flying-control rods
13 Access panels to 10, 11, 12
14 Accessory gearbox
15 Alternator
16 Generators
17 Transmission oil cooler
18 Rear rotor-drive shaft
19 Front fuel tank (280 imp. gal)
20 Intermediate fuel tank (164 imp. gal)
21 Intermediate tank filler
22 Rear fuel tank (116 imp. gal)
23 Rear tank filler
24 Engine-oil tank
25 Oil-tank filler
26 Access doors to cable conduit
27 Walkway
28 Napier Gazelles (front and rear)
29 Engine exhausts
30 Pilot's seat
31 Co-pilot/navigator's seat with folding back-rest
32 Walkway door
33 Walkway door
34 Main door (can be replaced by canvas screen)
35 Winch in door
36 Door-locking strut
37 Stand-by hand crank for winch
38 Crewman's seat
39 Window with rip-strip for crash rescue
40 Port escape hatch
41 Castoring front wheel
42 Strong-points for equipment and loads
43 Radio racks
44 Main electrical fuse panel
45 Folding ladder
46 Ladder attachment points (also in way of rotor heads)
47 Collective and cyclic pitch control spider
48 Centrifugal droop-stop bobweights
49 Intakes for engine and gearbox cooling air

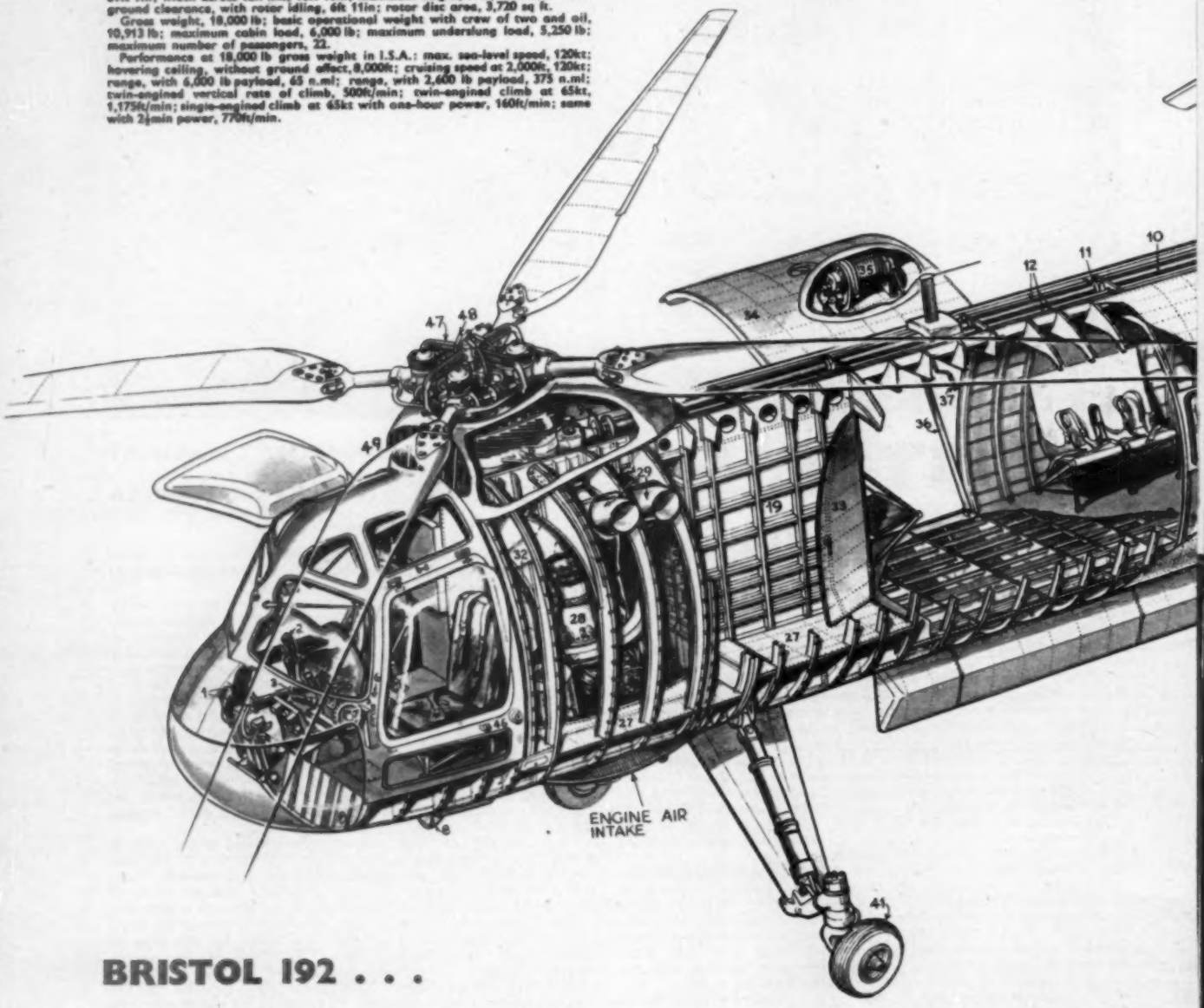
BRISTOL 192

Two Napier Gazelle NGa.2 Free Turbine Engines

Fuselage length, 54ft 4in; rotor diameter, 48ft 8in; maximum overall length, 89ft 9in; width across tail fins, 18ft 10in; maximum height, 17ft; minimum rotor ground clearance, with rotor idling, 6ft 11in; rotor disc area, 3,720 sq ft.

Gross weight, 18,000 lb; basic operational weight with crew of two and oil, 10,913 lb; maximum cabin load, 6,000 lb; maximum underslung load, 5,250 lb; maximum number of passengers, 22.

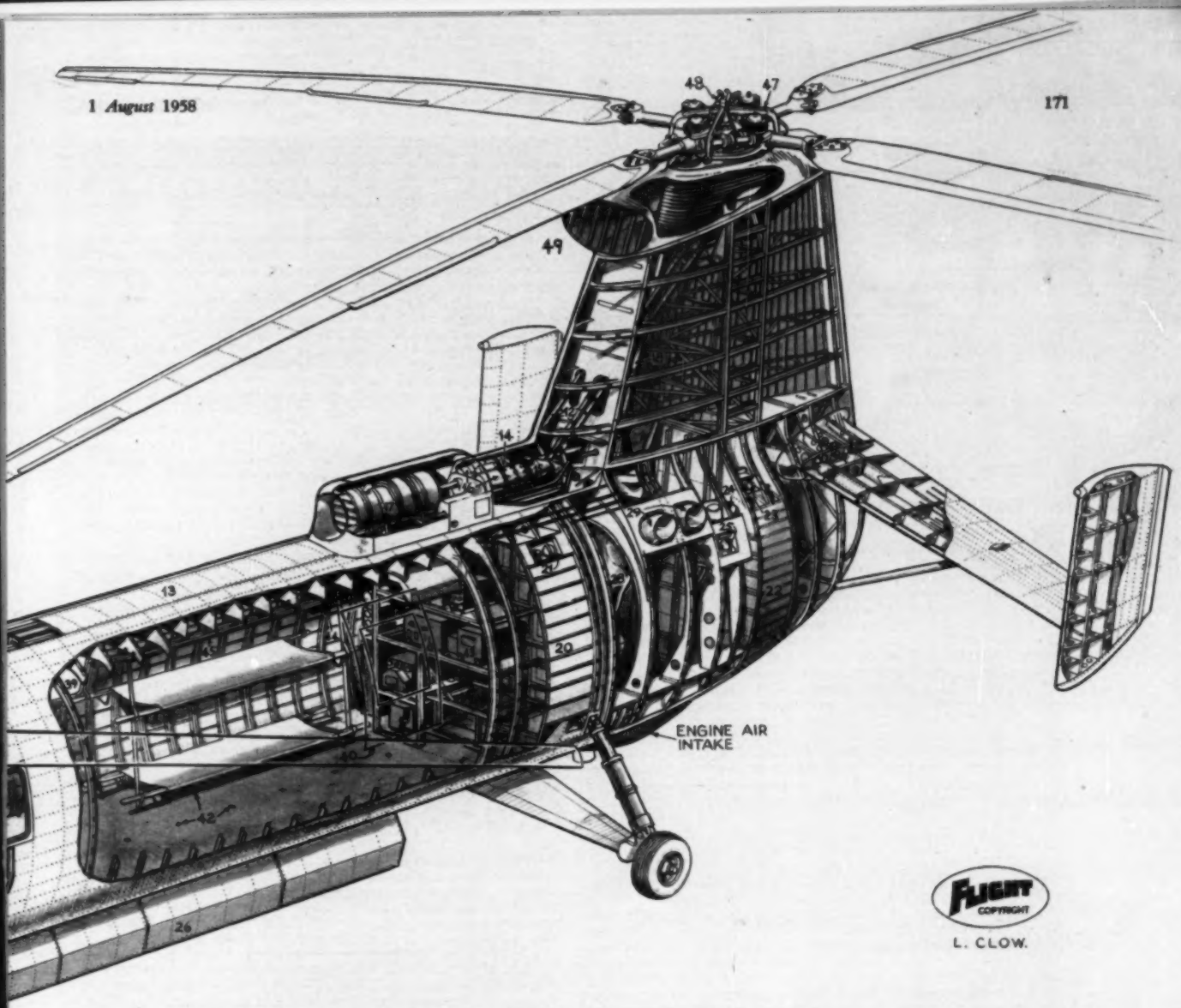
Performance at 18,000 lb gross weight in I.S.A.: max. sea-level speed, 120kt; hovering ceiling, without ground effect, 8,000ft; cruising speed at 2,000ft, 120kt; range, with 6,000 lb payload, 65 n.mi; range, with 2,600 lb payload, 375 n.mi; twin-engined vertical rate of climb, 500ft/min; twin-engined climb at 65kt, 1,175ft/min; single-engined climb at 65kt with one-hour power, 160ft/min; same with 2½min power, 770ft/min.



BRISTOL 192 . . .

Leonides engines and flew on August 31, 1953. Whereas the first prototype had a V-shaped tailplane, the second had two pairs of small stub wings (beneath the tips of which the wheels were mounted) with vertical surfaces on the ends of the rear pair. These two prototypes were used continuously for investigation and development of various types of fixed lifting and stabilizing surfaces. The Mk 2 was damaged late in 1956 and the work was then continued on the Mk 1 alone, using the tailplane from the Mk 2.

The stub wings fitted to the Mk 2 were used to investigate the possibility of increasing cruising speed by providing auxiliary lift in forward flight. By relieving the rotors of part of the load they permitted lower blade angle of attack, thus delaying the stalling of the retreating blade root and giving a higher cruising speed. The stub wings were operated at a high lift-coefficient (approx 0.75) and had innocuous stalling characteristics, in order to avoid unwanted trim-changes when decelerating from cruise to hover. They were designed to take one-third of the aircraft weight at cruising speed. Tail surfaces were designed to increase longi-



tudinal and directional stability and it was from experience gained on the Mks 1 and 2 that the anhedral tailplane with small vertical end fins, now seen on the 192, was developed.

Meanwhile, from 1952 to 1953, development went ahead with the more powerful Leonides Major engines which had then become available, permitting a much heavier aircraft with greater payload. Three prototypes, designated Mks 3, 4 and 5, were constructed with these engines and four-bladed rotors as now fitted to the 192.

The Royal Navy had shown a interest in the 173 from 1950. An order was placed late in 1953 for a number of aircraft to be developed from the 173 Mk 5, and this type was designated 191. Carrier trials with the 173 Mk 1 took place in 1954 in H.M.S. *Eagle*. Though minor difficulties were encountered—it was found, for example, that in order to fold the rear rotor blades before striking-down it was most convenient to lower the tail of the aircraft a few feet on the carrier's lift—the trials were successful and the 173's ability to land and take-off in the high winds encountered over the flight-deck was established. To meet the Naval requirement, the projected 173 Mk 5 and its successor the 191 were to have a shorter fuselage (the Mk 1 had had its tail-cone removed in order to fit *Eagle's* lift) and a shorter rear undercarriage to permit torpedoes to be loaded at deck level.

The R.A.F. had meanwhile placed an order for an aircraft to be developed from the 173, and this was designated Type 192. At about the same time Napiers announced the Gazelle free-turbine engine and both the Navy and the R.A.F. decided that Series 2 versions of both the 191 and the 192 should be built with this engine. Bristols were thus committed to completion of the 173 Mks 3, 4 and 5, the 191 (Series 1 and Series 2) and the 192 (Series 1 and Series 2)—these last being production orders.

A change of Admiralty policy in 1955 resulted in the cancellation of the Navy's order and the R.A.F. made a decision to sidestep the 192 Series 1 and go straight on to the Series 2 with Gazelles. It was therefore decided to discontinue development of the Leonides Major aircraft. The 173 Mk 3 was retained (it flew on November 9, 1956) while the Mks 4 and 5, nearing completion, were diverted for use as test rigs and for trial installations. The first two fuselages of the Type 191 were also completed as test rigs and it was on these that much of the pre-flight development of gearboxes and shafts for the 192 was carried out. The rigs have also been used for resonance tests, installation and testing of controls and systems and other experimental work. The result of the flying of the Type 173 prototypes and the work on these test rigs is that the Type 192 components are probably the most intensively tested that have ever gone into a helicopter.

Metal rotor blades, to be offered as an alternative to the wooden blades on the first 192, have meanwhile been both test-run and

The 192 cockpit is simple in layout. Flight instruments are to starboard, in front of the pilot, while engine and fuel controls and gauges are on the central console. A large equipment rack is to port. The throttles for ground running are beyond the longitudinal trim wheel.

BRISTOL 192 . . .

flown on a Sycamore up to speeds of 110 kt and have proved to be smooth in flight and to produce light stick-forces.

Other offshoots of the Bristol twin-engined tandem-rotor family are two studies for civil aircraft. The first is the Type 192C, which could be built on the same jigs and with virtually the same powerplant, transmission and rotors as the military version. A seventeen-seater, it would have a still-air range of 390 n.m. with 2,180 lb payload or 200 n.m. with 4,000 lb payload. But Bristol feel that the ideal specification for a passenger transport would be a larger helicopter capable of carrying about 35 passengers over a 150-mile stage. The cruising speed should be at least 160 m.p.h., and to achieve this speed a stub wing carrying about 40 per cent of the gross weight is necessary. Bristol have prepared a design study to this specification, designated Type 194. It would be longer, but have the same rotors, power being provided by two free turbines of about 2,400 rated s.h.p. each. Maximum gross weight would be between 22,000 and 25,000 lb.

Type 192 Structure. The structure of the 192 is an orthodox semi-monocoque using light-alloy Z-section stringers and frames. The main cabin has a constant ovoid cross-section 24ft 1in long, 5ft 3½in wide and 4ft 11in high with an unobstructed floor. Upward-opening, fully glazed doors provide access to the crew compartment, and a large blister in the port door provides extra downward and rearward view. There is a single window on each side of the main cabin, an additional window being fitted in an escape hatch aft and to port. The large main access door forward and to starboard may be jettisoned; and it may also be hinged upward and locked open by a spring strut to form a mounting for an electric winch fitted in the door. The winch may be controlled either by the crewman or the pilot. The two engines are mounted in sealed bays fore and aft of the main cabin, with a single fuel tank occupying most of the fuselage cross-section aft of the front Gazelle. The two rear fuel tanks are located in bays fore and aft of the rear engine.

The port flank of the forward fuselage is bulged abeam of the front engine to allow space for a narrow gangway between the cockpit and the cabin. After folding the back-rest of his seat, the co-pilot (who in a helicopter sits on the left) can open a folding door and pass down this gangway, through a further door, and into the cabin. A rearward-facing seat with a head-rest is provided for the crewman on the rear bulkhead of the front fuel-tank bay.

The front undercarriage loads are taken by the forward bulkhead of the front fuel-tank bay and by an auxiliary bulkhead beneath the floor. Front rotor loads are taken by two longitudinal beams and an arched frame adjacent to the bulkhead separating the cockpit from the engine bay. Access to the rear fuel tank and the rear fuselage and fin is facilitated by a door on the underside of that portion of the fuselage. Rear rotor loads are taken by a box structure formed by the three fin spars and the skins between them. Leading and trailing edges of the fin are unloaded fairings, the leading edge being detachable for access to the control rods and bell cranks. Forward of this the control rods run in the trough in the top of the fuselage alongside the synchronizing shaft. A further conduit beneath the fuselage is covered by arched panels designed to take water loads in the event of ditching.

Tailplane and end-plate fins are made up in a conventional manner of a main spar and torsion box, with diaphragm ribs supporting the light-alloy trailing edges. The tailplane, which has considerable anhedral, is braced on each side by a tubular strut.

In order to allow torpedoes to be wheeled directly up to their carriers under the centre fuselage the 191 Naval helicopter was to have a considerably extended forward undercarriage providing some 4ft 2in clearance between the fuselage and the ground. This configuration has been retained in the 192, and the sill of the main loading door is therefore 4ft 10in above ground level. Fuselage-to-ground clearance at the after undercarriage is 2ft 1in. Each undercarriage unit consists of two radius rods in the form of torsion boxes carrying a landing wheel at their outer extremities and supported and sprung by Messier telescopic struts. The two undercarriage units are equidistant from the c.g. and have a wheel base of 30ft and a track of 10ft. Only the front wheels swivel. The system is designed for a normal vertical touch-down velocity of 8ft/sec and an emergency velocity of 12ft/sec. The undercarriage is arranged to allow the helicopter to roll about its principal axis of inertia, rolling relative to the undercarriage being controlled by a damper strut at the roots of the radius rods. Landings on a sloping surface are thus possible, and ground resonance is avoided. All four wheels are of 18in diameter, carrying tyres 5.5in wide inflated to a pressure of 180 lb/sq in.

Transmission and Rotor Systems. Each of the two rotors, 48ft 8in diameter, has four wooden blades identical with those of the Sycamore. Root chord of each blade and taper ratio are respectively 25in and 0.62, while the disc area of each rotor is 1,860 sq ft. Maximum design tip speed is 687 ft/sec.

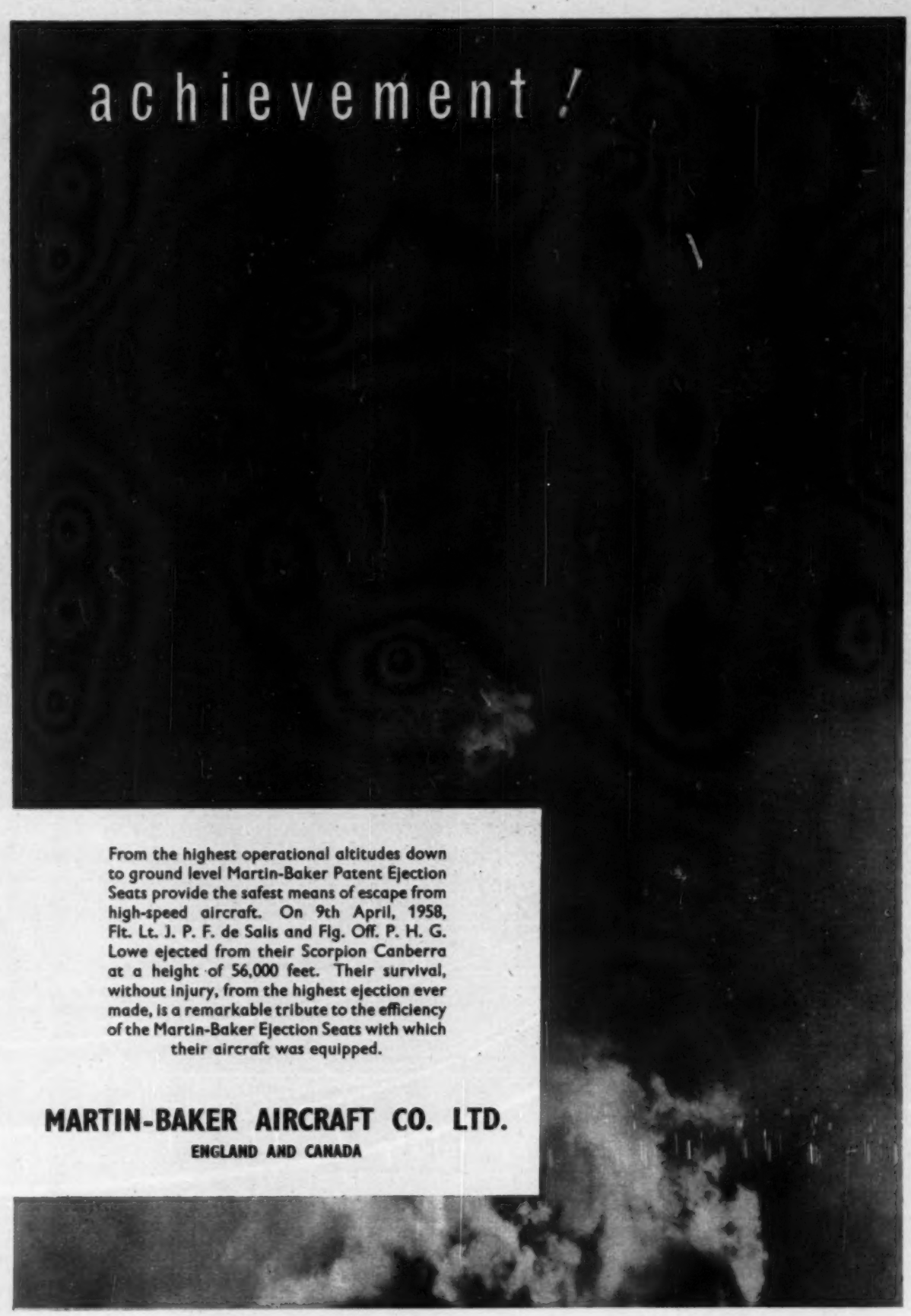
Each rotor head is similar to that of a Sycamore, having a spider to control both cyclic and collective pitch of the blades. Each blade is secured to the hub by a tie bar, a friction damper being provided to counteract blade drag. Further dampers are provided between the blade roots; and a centrifugal droop stop mechanism engages a cam to prevent any of the blades striking the fuselage when rotor speed is insufficient to keep the blades in the correct plane by centrifugal force. The rotor blades are not designed for folding, as the R.A.F. has not stated such a requirement. Later 192s will have constant-section, all-metal blades in which the leading edge and root structure are formed from a single light-alloy extrusion.

Gazelle power is transmitted by the output shaft to a 11.98 reduction gearbox beneath each rotor head. Rotor speed range is between 220 and 260 r.p.m. Seen from above, the forward rotor turns in an anti-clockwise direction and the rear rotor in the opposite sense, reverse rotation being produced by an internal spur gear in the forward gearbox. As already stated, the free-turbine output of the Gazelle eliminates the need for free-wheel and clutch systems, but a Goodyear disc brake is incorporated in the front reduction gearbox to allow the rotors to be stopped rapidly after landing. The front Gazelle is inclined forward relative to the fuselage datum, and has its output shaft parallel to the axis of rotation of the rotor. The rear Gazelle is inclined rearward and the input pinion to the gearbox is bevelled to accommodate the difference between shaft angle and rotor axis.

To permit single-engined operation, and because the rotors overlap, a synchronizing shaft positively links the two rotor transmissions. It extends from a bevelled gear in the front gearbox and along a trough in the top of the fuselage to an intermediate gearbox between the rear Gazelle and the rear rotor gearbox. This intermediate gearbox additionally accommodates a bevelled gear and shaft driving the accessory gearbox on top of the fuselage. Transmission-to-accessory drive ratio is 20:29. A further shaft is taken from the intermediate gearbox to drive a stack of three gear pumps supplying lubricating oil to the three gearboxes. Pressure is sensed at the inlet to each gearbox and temperature at each outlet.

Oil is drawn from a 6-gal supply in an 8.5-gal tank and returned, from intermediate and rear gearboxes, by gravity to a de-aerating cascade in the top of the tank. The oil then falls on to a baffle from which it is drawn by a pump in the accessory-drive system and passed through a 12in Serck radiator in the oil cooler. Air is entrained through the cooler by a two-stage Jicwood fan driven by the accessory shaft. Because of the length of piping between front gearbox and tank, a scavenge pump next to the front gearbox pumps oil from this area back to the tank. The oil tank may be replenished from outside the fuse'age and the filter can be withdrawn through the top of the tank.

Control System. The 192 flying control system is based on that of the Sycamore and 173, with additional facilities for an autopilot. The spider at each rotor head controls the blade-pitch lever arms and is tilted by the cyclic-pitch control axle, whose lower end is connected by push-rods to the cyclic control stick in the cockpit. The pitch control axle is itself carried by a ball joint in the collective-pitch sleeve so that the spider may also be moved up and down, by a linkage to the collective lever in the cockpit, to alter the collective pitch. [*Contd. on p. 173*



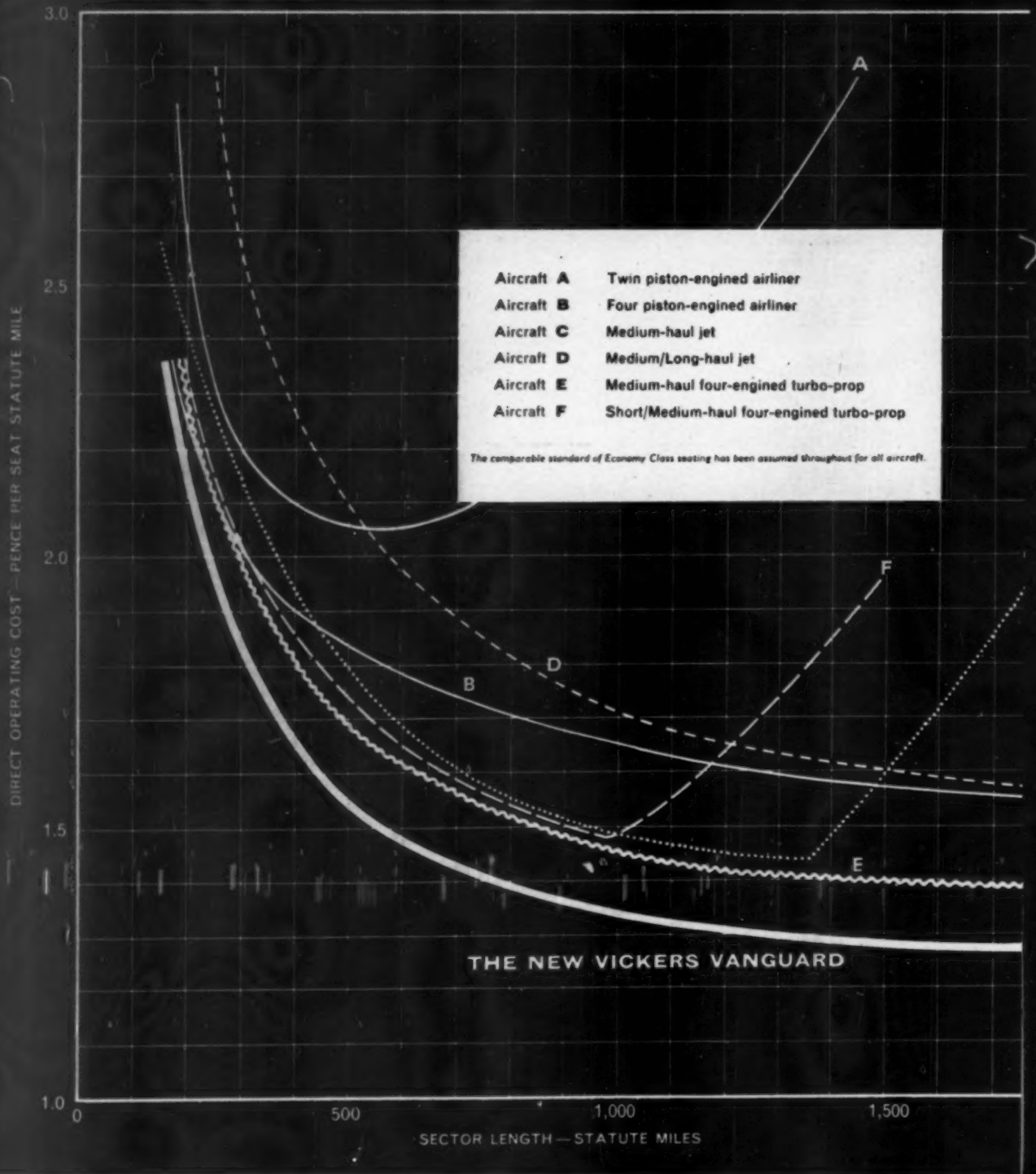
From the highest operational altitudes down to ground level Martin-Baker Patent Ejection Seats provide the safest means of escape from high-speed aircraft. On 9th April, 1958, Flt. Lt. J. P. F. de Salis and Flg. Off. P. H. G. Lowe ejected from their Scorpion Canberra at a height of 56,000 feet. Their survival, without injury, from the highest ejection ever made, is a remarkable tribute to the efficiency of the Martin-Baker Ejection Seats with which their aircraft was equipped.

MARTIN-BAKER AIRCRAFT CO. LTD.

ENGLAND AND CANADA

With the NEW VANGUARD

Fares can be cut



by up to 50%

MILLIONS OF PEOPLE are waiting to fly—but cannot afford it. Airlines need large increases in passengers if they are to make profits, yet cannot reduce fares sufficiently to attract them. Now this vicious circle can be broken with the new Vickers Vanguard. The accompanying graph of operating costs demonstrates how the Vanguard scores over all other competitive aircraft. This graph was not drawn by Vickers but by the Projects Department of one of the world's major airlines.

PROFITS CAN BE INCREASED

At 65% passenger load factor the new Vanguard, in its 139-seater thrift layout, can operate at a 10% clear net profit with fares ranging from 29-50% below current tourist rates. In calculating these figures, actual routes, current fares and current costs have been used.

FLEXIBILITY IS IMPROVED

The graph takes no account of another outstanding aspect of the new Vanguard—its operational flexibility. This jet-prop advantage permits low level routing, holding stacks, and diversions without operational crises or financial losses.

How *can such assured claims be made for the new Vanguard? Because it was designed for the realities of airline economics!*

ONLY THE VANGUARD HAS ALL THESE FEATURES

425 m.p.h. cruising ★ Break-even load factor under 50% on all stages from 200-1800 miles ★ Freight capacity 10 tons at normal densities ★ Full routing and A.T.C. flexibility ★ Can use normal existing airfields ★ Quick turn-round ★ No airfield noise problems ★ Quiet, smooth flight ★ Ten years' unique Vickers/Rolls-Royce jet-prop experience

Adjusted Airline Distance allowing for 30 knot head-wind and Airways routing. Stat. Miles	Present Single Fare (Tourist)	Vanguard Single Fare. Economy Class to give 10% profit on 65% passenger load	Percentage Fare Reduction Possible with New Vanguard
238	£9 . 1 . 0	£6 . 4 . 0	31.5
239	£8 . 17 . 0	£6 . 5 . 0	29.0
256	£9 . 4 . 0	£6 . 8 . 0	30.5
450	£16 . 0 . 0	£9 . 4 . 0	42.5
543	£17 . 15 . 0	£10 . 9 . 0	41.0
686	£24 . 0 . 0	£12 . 0 . 0	50.0
804	£26 . 6 . 0	£14 . 5 . 0	46.0
880	£26 . 17 . 0	£15 . 6 . 0	42.7
1000	£32 . 8 . 0	£17 . 0 . 0	47.5
1010	£30 . 11 . 0	£17 . 2 . 0	44.0

The table above shows the dramatic fare reductions possible by using the new Vanguard as a short and medium haul vehicle in Economy Class. The figures are based on a 65% load factor and allow a 10% profit. Actual routes, current fares and current costs have been used.

PROFIT with the NEW

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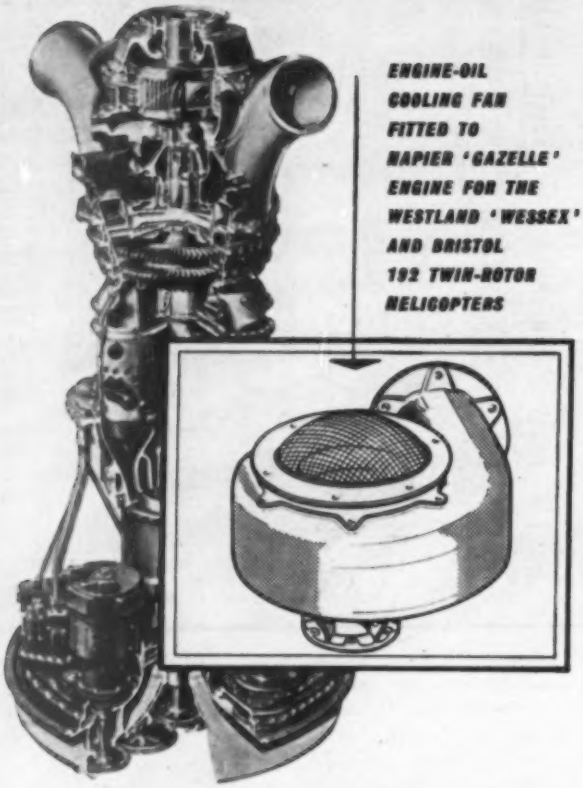
FOUR ROLLS-ROYCE TYNE PROPELLER-TURBINE ENGINES

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

TGA AT594

NAPIER 'GAZELLE'

...fan by AIRSCREW



ENGINE-OIL COOLING FAN FITTED TO NAPIER 'GAZELLE' ENGINE FOR THE WESTLAND 'WESSEX' AND BRISTOL 192 TWIN-ROTOR HELICOPTERS

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B T-H

AIRCRAFT EQUIPMENT

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BRISTOL 192 HELICOPTER

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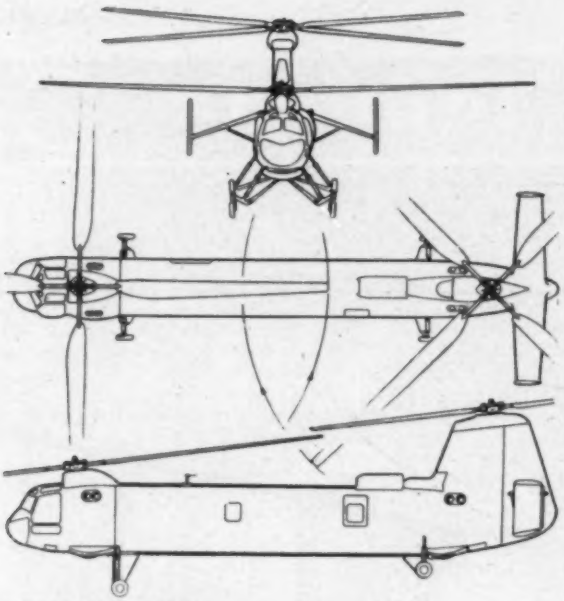


BRISTOL 192 . . .

Directional control, exercised from the rudder pedals, is achieved by equal and opposite displacement of the cyclic pitch of the two rotors, while vertical displacement is controlled by the collective pitch lever, which also adjusts engine power to maintain substantially constant rotor r.p.m. Fine power-adjustments can be made with a twist-grip on top of the collective lever. The engines may also be controlled from individual throttle levers on the console between the pilots. Forward movement of the cyclic lever causes simultaneous cyclic-pitch changes in both rotors; and a mixing box provides for a differential collective-pitch change to ensure suitable pitch displacement of the fuselage. Lateral control is achieved, from the cyclic stick, by equal cyclic-pitch changes in both rotors. Longitudinal trim changes caused by alterations in c.g. or other factors can be countered by differentially adjusting the collective-pitch settings of the two rotors from a handwheel on the central console.

Anti-spring assemblies in the collective and cyclic control systems counteract propeller moment, blade tie-rod loads and gravitational loads and ensure that the control forces needed to change pitch throughout the pitch range are small.

A Newmark helicopter autopilot (described in *Flight* for May 16) can be engaged to operate the controls through three electric servo motors in the longitudinal, lateral and yaw linkages. It can be set for stand-by, stabilize, cruise and hovering modes so that the machine can variously be stabilized and manœuvred by the pilot, held to a given heading and attitude in cruising flight, or held to a heading and stabilized while hovering. A height control will later be added to the last function; and provision will be made for radio-coupling for homing and approach. The first pilot has a full complement of blind-flying instruments.

Engine Installation. Each Gazelle is mounted from pads on the main support plate between the compressor and combustion sections, further pads on the reduction gear casing being fitted with arms transmitting torque reaction from the final drive to the airframe. A titanium fireproof cowling surrounds each engine; and cooling air is entrained through this cowling by a fan driven from gearing at the intake (lower) end of the engine. The same gear system drives fuel and oil pumps, oil cooler and r.p.m. generator. A single lever controls each engine through the fuel metering unit, automatic compensation for variations in flight conditions being provided at the engine. Full fire-detection and suppression equipment commensurate with the ability of the 192 to fly continuously on one engine is provided.

Main intake air for the Gazelles is drawn through elliptical openings on either side of the under fuselage formed by the dished access panels beneath each engine. Some air is also drawn in from above, providing a cooling flow for the engine reduction gear. The normal Gazelle quadruple exhaust pipes emerge on each side of the fuselage. Engine starting is by B.T.H. iso-propyl nitrate units provided with sufficient fluid for five starts at each engine. Three of the necessary cartridges are located within the starter, while those for the remaining two starts for each engine are carried in a container next to the crewman's seat in the cabin. The engines are installed and removed from underneath.

Fuel System. The normal fuel load of 560 Imp. gal is carried in three flexible bags (by Fireproof Tanks, Ltd.) located respectively in a bay immediately aft of the forward engine, and in two transverse bays fore and aft of the rear engine. Their respective capacities are 280 gal, 164 gal and 116 gal—a total of 280 gal for each engine. Transfer is effected by SPE booster pumps in sumps beneath the front and intermediate tanks and controlled by electrically operated Saunders valves. Simmonds Pacitor capacitance units in each tank control the readings of two gauges in the cockpit, while Elliott Brothers (London) gauges indicate fuel flow to each engine. Correct working of the booster pumps is shown by doll's-eye indicaters in the cockpit. Refuelling is by gravity through nozzles in the side of the fuselage. Provision is made for the carriage of overload tanks in the cabin, and additional pumps in these transfer fuel through Flight Refuelling cut-off valves so that the overload tanks are emptied first.

In normal operation the two rearmost tanks feed the rear engine, but a transfer pipe and valves allow fuel to be passed from rear group to front tank or *vice versa* as required. In addition, special arrangements are made for jettisoning fuel. In five minutes the fuel load can be reduced by jettisoning to 50 per cent of the maximum. For this purpose the rear tank is completely emptied and the contents of the front tank are reduced to the half-way mark according to fuel gauge indications. A further jettisoning operation will reduce the available fuel to 25 per cent of the maximum and, as this operation must be performed accurately, stack-pipes are provided in the front and intermediate tanks.

The purpose of this jettisoning arrangement is to allow the 192 to take off with a full fuel load for a search-and-rescue operation and then to reduce fuel contents quickly to either 50 per cent or 25 per cent of maximum in order to allow a full payload to be picked up without a wait to burn-off fuel.

Electrics and Radio. A Bristol 192 carries two English Electric 4kW, 28V generators and two English Electric 9kVA, 200V, 400 c/s alternators all driven by the accessory gearbox on top of the rear fuselage. The 28V supply is used for the standard range of lighting and other services, while the 200V A.C. supply is converted by an English Electric rotary transformer to 115V three-phase current for instruments, compass, j.p.t. and fuel-flow gauges and fire-warning circuits. A 115V single-phase supply is adapted from this for the radio. A further transformer provides 26V A.C. current for engine-oil pressure sensing.

The 200V A.C. supply, for which a ground connection is incorporated, is used for windscreen de-icing and for three Plannair blower-heater units, two of them in the cockpit and one in the main cabin. About 3kW of waste heat from the radio racks in the rear of the cabin will also provide some cabin heating.

A considerable number of different radios can be accommodated in the 192, including Tacan, D.M.E., Sarah, Decca Navigator, radio altimeter and I.F.F., but standard equipment will initially consist of a ten-channel V.H.F. radio, H.F./R.T. and Marconi AD.722 miniaturized A.D.F. The intercom system can accept inputs from five different radios, and three station boxes are provided. There are three p'ain intercom points.

When transmission r.p.m. are too low to operate the alternators effectively, an inverter driven by the D.C. system is automatically cut in to produce 115V A.C. current. A Varley 24V, 25 amp hr battery is also included in the D.C. circuit.

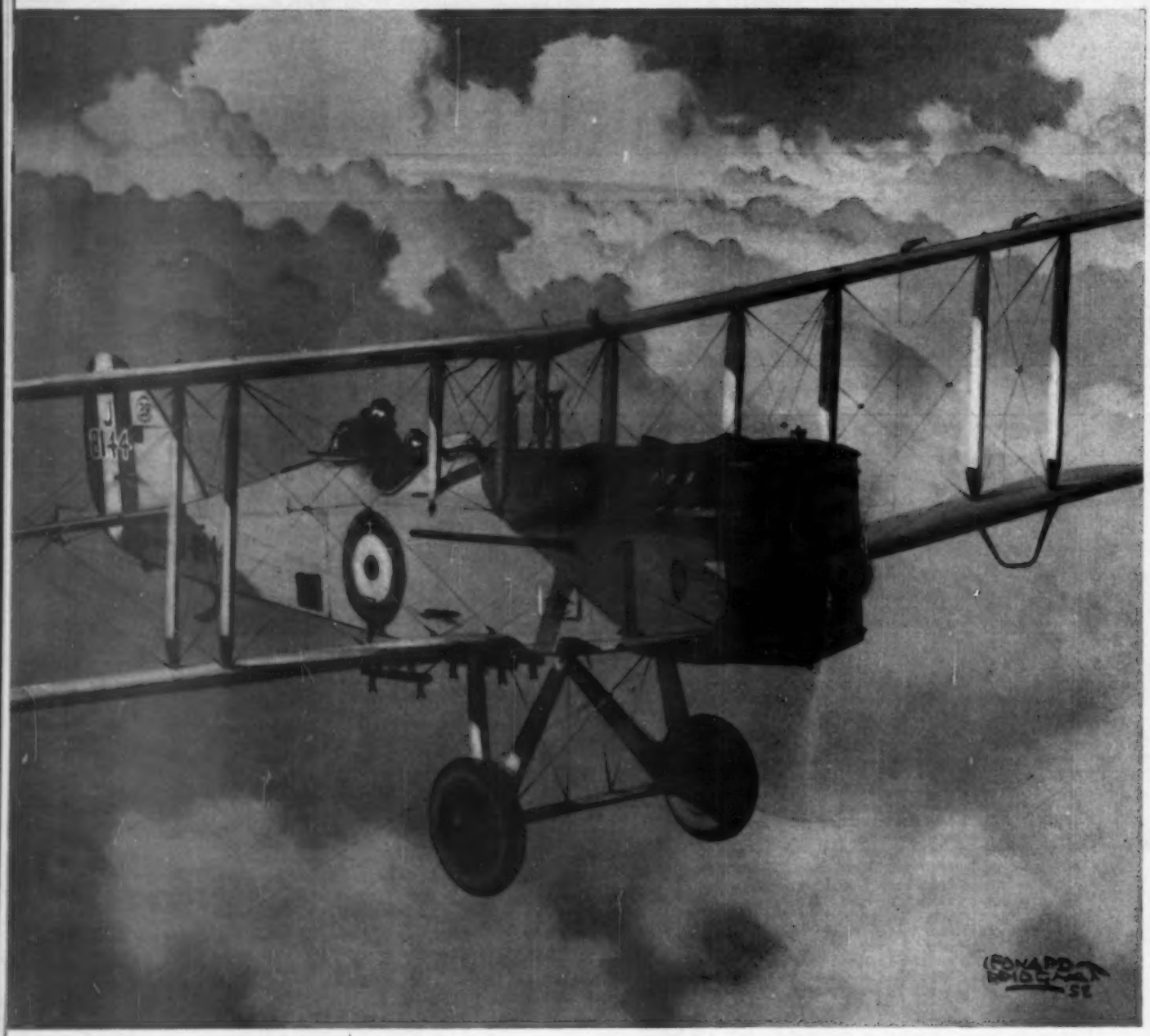
Hydraulic power is used in the 192 only to operate the wheel and rotor brakes. Palmer disc brakes on all four wheels are controlled by a hand-grip and parking catch on the cyclic-pitch control stick through Messier adjustable reducing valves. A Goodyear disc brake mounted at the forward end of the synchronizing shaft serves to stop both rotors when a hand lever in the cockpit roof is pulled. Hydraulic pressure at 1,300 lb/sq in is achieved by a hand pump in the cockpit and the contents of the accumulator are sufficient for two rotor-brake operations and five wheel-brake applications.

Flight tests of the 192 at Weston-super-Mare are now well under way and some hours' flying have been completed. The first machine is painted white and registered XG 447; and it will undoubtedly be seen by the public at the coming S.B.A.C. display at Farnborough in September.

C. M. L.

There is a certain contrapuntal harmony in the drooping lines of the 192's tail and undercarriage members and the fins.

"All these were honoured in their generations,
and were the glory of their times"
(Ecclesiasticus 44, 7)



D.H.9A
NO. 39 SQUADRON

Straight and Level

I DO not see why Lord Douglas finds it so "galling" that Sabena have "beaten B.E.A. to it" in inaugurating a service to Moscow.

The British Government has told the Russians that the Tu-104 is too noisy. The Russians say that they cannot suppress the noise without unacceptable loss of performance, but sign bilaterals with the Belgians, French and Dutch.

I am sure that it would be a politically splendid thing for B.E.A. to carry the British flag into Moscow. But I doubt whether such an operation makes much commercial sense—and this is all that should really matter to B.E.A. The key to the economic health of any operator, and particularly a short-haul operator, is route density—i.e., load tons per route-mile. Far too many airlines continue to think more about opening new routes than they do about intensifying existing ones. (I would think twice about opening further trans-polar services; and I award B.O.A.C. a medal for not having rushed on to this particular "quality competition" bandwagon.)

B.E.A. have a long way to go before they can feel satisfied with the intensity of their operations. So Lord Douglas need not worry too much about being unable to add to his network the 1,500 miles to Moscow—especially as its traffic-offering is unlikely to be particularly heavy, and certain to be highly sensitive to political fluctuations.

And I am sure he feels, in his heart of hearts, that the Government is right to stick to its guns about unreasonable jet noise. *Someone* has to, because the airlines and the manufacturers are no respecters of the public eardrums. Much as we should like to see the Tu-104 in and out of L.A.P., the Belgians, the French and the Dutch are, for the present, welcome to its unmitigated din.

● Pilots as a race are by no means insensible to the wondrous beauties of the sky. One professional pilot of my acquaintance almost collided with an adjacent aircraft because he was intently studying a distant cloud formation; another, with many thousands of hours of airline service, forgot to call up at a beacon simply because he was mesmerized by the changing appearance of an exhaust pipe as dawn broke (and it gradually ceased to appear brighter than its background). Put a black box in the most heavenly surroundings and it will not be distracted.

● My word, the bottom really is falling out of the used-airliner market. I hear that a four-engined airliner, in perfect working order, was recently bought for considerably less than £1,000.

Mind you, it wasn't everyone's idea of an efficient ton-mile producer: it was the last remaining de Havilland D.H.86 Express (four D.H. Gipsy Six), G-ACZP, built in 1934. It was bought by the Hampshire Aeroplane Club, which can claim to be the only flying club in the world (apart from I.A.T.A.) operating a four-engined airliner.

The inscription on the Spitfire presented by Fighter Command to the U.S.A.F. certainly took the cake—right out of Ye Olde Englishe Bunne Shoppe. That black-letter banner would have looked more at home on the poop-deck of the *Mayflower*. Who *is* the arbiter of taste in such matters?

● One of my *Flight* colleagues had a phone call the other day from an executive of a British aircraft company, who was preparing the chairman's annual report. He wanted some information—simple things like the approximate number of aircraft operated by B.O.A.C. and B.E.A., by U.S. operators, and by British Commonwealth operators.

I think that I would be ashamed thus to publicize the fact that my firm did not file the annual reports of B.E.A. and B.O.A.C.; I.C.A.O.'s register of airline fleets; and *Flight's* "Airlines of the World" number.

● Talking to an eminent aeronautical engineer the other day I picked up this bit of advice. He said: "Any piece of equipment is more useful if it is mobile. Any test gear in my factory that can possibly be put on wheels is put on wheels." His firm have been buying up old caravans in order to use their chassis.

● With other representatives of the technical and national Press a colleague spent a day with one of the most famous and respected of British manufacturers. During the informal lunch a senior member of the firm waxed controversial about certain sections of the British daily Press, in particular about their treatment of aviation affairs. "I dread to see the mess they will make of this story tomorrow," he said.

Regardless of whether he was being a good host or not, he was saying something which I have often heard voiced in the aircraft industry. I expect you know the sort of thing: "The papers are only concerned with sensations . . . they don't care about anything good we do . . . they always slant and 'angle' everything . . . their stories bear no relation to the facts . . . they're only interested when things go badly . . ." etc., etc.

You would not hear so many people saying such things so often unless there were some truth in them. But I suggest that one remedy may be in the hands of the industry. I remember the story of another colleague who was in the New York office of a progressive foreign airline when a really scurrilously inaccurate story about that airline appeared in an influential news magazine. The reaction was not the despatch of a hurt letter, or an icily worded demand for a correction, as it would probably have been in this country. The magazine was given an exclusive (and correct) story about something else.

In that sort of attitude may lie the seed of happier relations between the British aircraft industry and the newspapers. Or am I wrong? And are these relations as good as they ever can be?

● Airlines and manufacturers are friendly people, but they reserve the right to be sceptical of one another's understanding of their problems. The manufacturer is never really convinced that the airline knows its own mind, or appreciates the time-demanding delays involved in making specification changes; and airlines, for their part, generally frankly disbelieve anything the manufacturer has to say about the cost of operating his aeroplane; after all, he's the seller and probably he can never understand just what a difficult network the customer airline has to cover.

Now that extraordinary firm at Weybridge have completely upset the old order of scepticism by publishing an *airline's* cost analysis of their 29,000 lb-payload Vanguard—and very good it looks, too. It certainly provides a working basis for other airlines who wish to examine the Vanguard's profit potential on their own routes. It would help them more, of course, if they knew the airline that carried out the study, and could relate their operating conditions to their own. But this, for obvious reasons, Vickers can hardly be expected to reveal.

● I see that DC-8 and Comet 4 range-payload figures are being quoted "with noise suppressors." There is no doubt that these devices diminish range-payload performance. But so do jet-pipes, intake ducts, cabin air systems, de-icing systems. Why show an allowance for something which is now as much a basic part of a jet airliner's propulsion system?

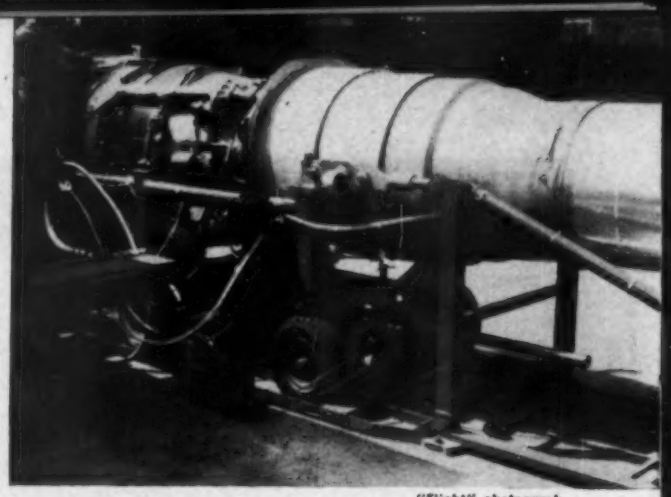
● Poor old pilot—he is "responsible for *every* accident, even if a wing falls off," a famous U.S.A.F. general is supposed to have declared. "*Especially* if a wing falls off," he added.

ROGER BACON

The Industry

Turbojet Run-up Stand

NEW EQUIPMENT FROM JOHN CURRAN, LTD.



In the Curran turbojet run-up stand, the rubber-tyred trolley (left) carrying the engine, is located in steel channels and hooked up to the light, triangulated hold-back frame at right.

"Flight" photograph

THE latest production of John Curran, Ltd., of Cardiff, is a turbojet run-up stand, produced in response to a Service requirement for a simple means of check-running and adjusting an engine after removal from an aircraft. Because they are usually buried in the airframe, many turbojets have to be unshipped for relatively minor adjustments; and in such cases they often have to be returned to their manufacturers. The run-up stand allows the engine to be simply and quickly set up for running so that small faults can be traced and adjusted easily and without delay.

Extremely simple, the stand consists of three units, a control cabin, an engine-transporter trolley and a restraining structure. The engine to be tested is lowered on to bearers on the rubber-tyred, towable trolley. This is then wheeled along metal guide-channels and hooked on to the restraining structure, which is a triangulated steel framework bolted to a concrete foundation. A jet-pipe, with thermocouples already connected, is held in the restraining structure; and a light protective fence is set up round the intake. Iso-propyl nitrate, electrical, fuel and throttle connections are made, the fuel being pumped straight from a bowser, through a filter, to the engine. The cabin, which is set up beside the engine, is made up of panels of 4in-thick sintered cork between plywood and has a double-layered, armoured glass observation window. Inside are a throttle and gauges for oil and compressor pressures and for oil, jet-pipe and rear bearing temperatures. The trolley may be rigidly anchored to the ground by screw-jack stays so that a seismic senser can be used for checking vibration.

In this form the stand could be of great assistance in routine checking and adjustment at an operational airfield; and the whole equipment can be readily removed and transported by air. Further additions might include sensers for fuel pressure at delivery, pump outlet and burners. Safety precautions include an emergency shut-off valve and ignition cut-off to allow interruption of the starting cycle. Portable fire-extinguishing equipment would also be kept on hand.

When demonstrated to a *Flight* representative recently, the run-up stand was holding a Rolls-Royce Avon 200 series engine; and in deference to local residents a mobile muffler of the type produced by Curran for the Scimitar (illustrated in *Flight* for April 4, 1958) was positioned aft of the jet-pipe; this reduced the noise by between 18 and 20 db. Electrical power was taken from the mains supply, but could in the field be provided by mobile generator or trolley-accumulator.

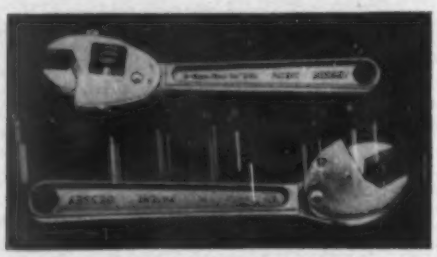
Present Curran production is concentrated on T-type stands for turboprops and J-type stands for Rolls-Royce Derwents which have been supplied to the R.A.F. and also to several foreign customers, including Brazil. In the J-type stand, the engine is mounted in a swinging structure like a gate, the thrust of the unit being measured by a pressure-gauge located at the outer end of the gate. A similar principle is employed for the turboprop stand, but the engine is mounted on top of a platform which has limited freedom to rock about the fore-and-aft axis of the engine. A measurement of the rocking moment caused by engine torque is factored to provide a direct reading of the shaft horsepower being developed. The fitting of different face-plates allows the testing of a variety of engines. Stands of this type are being supplied to the Middle East Aircraft Servicing Company at Beirut, for Dart and Proteus; to the Aircraft Carriers Engineering Services at Miami, for the Proteus; and to South African Airways Corporation, for the Dart.

Curran, incidentally, have also made all the deck-landing mirror sights for the Royal Navy, and Dutch, Canadian, Australian and French carriers. The size of the concave, polished aluminium mirror has now been reduced from 5ft × 4ft to 4ft × 3ft. Trailer-mounted mirror sights for training use at airfields have also been produced. In the ship-borne version, the mirror is gyro-stabilized in elevation to maintain a constant inclination relative to the horizon, regardless of ship movement; and manual winding gear and a telescopic sight are provided to allow manual stabilization relative to the visual horizon in case of gyro failure. If no horizon is visible, a bubble level is also fitted so that mirror guidance can be maintained in even the poorest weather. The whole mirror can be raised or lowered by two screw-jacks to allow for various hook-eye distances. This is because the pilot follows the glide-path with his eyes, whereas his hook is some distance below eye level, but must nevertheless accurately pick up an arrester wire. Vertical distance between hook and eye vary considerably from one aircraft type to another.

The company is also engaged in producing turning gear for radar aerials. Such structures must maintain the aerial in a constant attitude and rotate it at a constant speed regardless of wind conditions. With aerial assemblies weighing many tons this is no mean engineering feat.

IN BRIEF

Dealing with the corrosion-resistance properties of titanium alloys, a new information sheet—M.811—giving the most up-to-date information on the subject has been issued by Wm. Jessop and Sons, Ltd., Brightside Works, Sheffield, Yorks.



With these Bessey ratchet wrenches it is unnecessary to disengage the jaws from the nut for each turn. Adjustable and (lower view) assembly-line types are available in five sizes each. Sole U.K. agents for this German tool are F. C. Daniell and Co., Ltd., 146a Queen Victoria Street, London, E.C.4.

Some 15,000 sq ft of floor space will be added to the existing capacity of Plannair, Ltd., when their new factory (now under construction at Leatherhead, Surrey) is completed next October. The new premises will incorporate laboratories equipped with climatic test chambers and high- and low-temperature cabinets capable of simulating any climatic condition.

* * *

Mr. J. Strong, M.A., executive director of British Oxygen Gases, Ltd., has been elected president of the Institute of Welding for 1958-59 in succession to Sir Charles Lillicrap, K.C.B., M.B.E. Three vice-presidents have also been elected: Mr. A. Clifford Hartley, C.B.E., F.C.G.I., B.Sc., M.I.C.E., M.I.Mech.E., F.Inst.Pet.; Mr. G. Roberts, B.Sc., M.I.C.E.; and Mr. E. Seymour-Semper, M.I.Mech.E.

* * *

A new apprentice training school attached to the Plessey Company's works at Swindon was opened by the Mayor of Swindon, Ald. F. J. King, on July 10. It will be controlled by Mr. A. E. Balchin, M.I.Prod.E., the training and education officer, and a committee of executives and managers from departments of the Swindon group of factories. During their five-year training period, apprentices will be initiated into all aspects of engineering techniques at the factories, spending part of their final year in practical training for management duties.

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CIVIL AVIATION

ANSETT-A.N.A. BUY FRIENDSHIPS

IT will be remembered that a few weeks ago Mr. Reg Ansett, chairman of Ansett-A.N.A., said in London that his company was shopping for new branchline equipment to replace its 20 DC-3s, and that a decision between the Handley Page Dart Herald and the Fokker Friendship would soon be made. Last week Fokker announced that Ansett have signed an order for six Friendships.

A.N.A. were one of the first airlines to have their name coupled with the Herald; the decision of Ansett—who of course are now merged with A.N.A.—in favour of the Friendship is a hard blow to the British manufacturer, whose product greatly needs the encouragement of an order.

The fact that the Friendship is already ordered by T.A.A., Australia's nationalized domestic carrier, may have had some influence on Ansett's decision in favour of the Dutch aircraft. As Fokker point out, Ansett-A.N.A. also control Butler Air Transport and Queensland Airlines, a fact which is of the "utmost importance for the future of this Fokker product in the Australian continent."

Delivery of Ansett's six Friendships will start in about a year's time and is due for completion by the early part of 1960. T.A.A.'s Friendships (12 are on order) will be delivered early next year.

Ansett also have four Viscount 810s on order; whether their Friendships will be powered by the same version of the Dart—the RDa.7—has not yet been stated.

EL AL's BRITANNIA RESULTS

LAST week El Al spoke of their experience with the Britannia since they introduced three 313s into service at the turn of last year. In the first six months of 1958 business was more than doubled: 8,882 passengers were carried, compared with 3,456 in the corresponding period of 1957 when Constellation 049s were used.

The airline confirmed its order for a fourth Britannia for delivery early next year; in the meantime one of the surplus ex-Northeast Britannia 305s has been leased from Bristol in order to meet traffic demands (El Al's load factor, it is understood, has been one of the highest among North Atlantic operators). On the score of regularity, of 190 North Atlantic crossings all but four have been made non-stop since Britannia services began.

El Al are at present operating five return services weekly with their three Britannias between Tel Aviv and New York and logging an average of nearly a quarter of a million miles per month. Plans have already been announced for the use of the fourth aircraft. Starting on August 24, the airline is to introduce two additional Britannia services per week. These will be between Tel Aviv and London via Paris, and between Tel Aviv and Paris via Rome.

As previously reported (*Flight*, January 3), El Al are almost certain to buy big jets. Speaking in Tel Aviv last week, Mr. U. Michaeli, Israel's Director of Civil Aviation, said that the company would be able to hold their own with four Britannias until 1961; but that plans for jets would have to be completed by 1959. The Constellations must be disposed of soon, and replaced on European sectors probably by medium jets—Comets and Caravelles were mentioned by Mr. Michaeli.

The scene at Fokker, Amsterdam, at the moment of signing the order for Ansett's six Friendships, as recorded in the first item above.

Ghana Airways were inaugurated at Accra Airport on July 15 by Dr. Nkrumah; the first Stratocruiser to London is seen departing. Sir George Cribbett, deputy chairman of B.O.A.C.—joint shareholders with the Ghana Government and Elder Dempster Line—presented Dr. Nkrumah with a silver model of the Britannia.

U.K. AIR TRAFFIC IN 1957-1958

THERE is some sign, judging from the traffic statistics just released by the M.T.C.A., of a decline in the rate of growth of U.K. traffic in the last financial year, i.e., March 1957 to March 1958.

In this period the Corporations and the independents carried over 512.5 million C.T.M.s on scheduled services, an increase of 15.1 per cent over the previous year. Traffic carried rose by 10.9 per cent to 314.8 million L.T.M.s, though the load factor fell sharply—actually from 65.4 per cent to 59.2 per cent.

The table below shows statistics for B.O.A.C. and provisional statistics for B.E.A. (the latter will be confirmed on publication of B.E.A.'s annual report later in the summer).

The independents' traffic on scheduled services (operated in association with the Corporations) rose by 18.2 per cent on international routes and 27.1 per cent on domestic routes. The independents' overall load factor on scheduled services dropped from 62.2 per cent to 60.2 per cent. Inclusive tour services operated by the independents show a considerable increase: 137,416 passengers were carried compared with 92,081 in the previous year, and these passengers flew 91m passenger miles as against 54m in the previous year. Load factor on I.T.s rose from 70 per cent to 83.9 per cent.

The chief inference to be drawn from these statistics is that the Corporations' business, judging by the decline in load factor, did not come up to the expectations for which capacity was scheduled. Much of the traffic recession causing this decline took place in the last months of the financial year.

	B.O.A.C.		B.E.A.	
	Financial year 1957-58	% change from 1956-57	Financial year 1957-58	% change from 1956-57
Aircraft miles flown ...	40,149,000	+4.4	32,973,000	+10.4
Passengers carried ...	459,370	+16.0	2,765,591	+12.4
Freight carried (short tons)	8,911	+6.4	28,218	+9.5
Mail carried (short tons)	4,134	−0.3	7,465	−1.0
Capacity short-ton miles	313,283,000	+13.9	159,466,000	+15.4
Load short-ton miles ...	189,580,000	+8.2	101,246,000	+14.0
Overall load factor (per cent)	60.5	63.7*	63.5	64.3*
Available seat miles ...	2,096,598,000	+15.4	1,365,094,000	+18.6
Passenger miles flown ...	1,326,723,000	+10.5	935,756,000	+15.7
Passenger load factor (per cent)	63.3	66.0*	68.5	70.3*

* 1956-57 actual load factors.

NOISE IN THE HOUSE

IN the Commons last week Mr. Frank Beswick (Lab., Uxbridge) asked the Minister of Transport whether he was "aware that none of us wants to see London Airport by-passed [because of the Government's policy on jet noise], or a British Minister taking a responsible attitude and then finding that other countries are undercutting us."

Mr. Beswick urged that the Government should take steps to

CIVIL AVIATION . . .

get some international agreement on the question, and suggested that I.C.A.O. had a part to play in the matter. The Minister replied that in fact "we have quite a workable agreement"—that jets will be tried at each airport. While in America recently he had issued "a very warm invitation" to the Boeing 707, so that it could be tested under actual conditions at London. What had generally been agreed, said the Minister, was that jets should thus be tested under normal passenger operating conditions so that each authority could say what was *minimum* restriction that would protect the interests of people living near airports.

A DISAPPOINTING YEAR

B.O.A.C.'s annual report for 1957-58, to be reviewed in detail in our next week's issue, tells an even more sorry tale than had been expected. The auditors have had their final dig and the loss, previously estimated at £2¼m, now stands at a precise £2,839,350, a figure explained at some length in the report to be due to "bringing new aircraft into service . . . the fall in the price of primary commodities . . . inadequacy of suitable aircraft . . . the trade and economic recession in North America . . . the increase in interest charges . . . competition from the new and faster (Safari) Viscount services . . . the diminution of British cabotage rights."

Although the Britannias receive favourable comment, the report regrets "that their introduction into service has been seriously affected by late delivery from the manufacturers, with the result that outmoded types due for retirement had to be continued in the service of the Corporation after their effective competitive lives in front-line service had declined."

In the face of this formidable catalogue of woes, traffic was overestimated; so, while capacity was increased by 19 per cent, load grew by only 12 per cent. As a result, load factor fell from 63.7 to 60.5 per cent. The forecast figure was 64.4 per cent. While revenue rose by £4.5m to £53.5m, operating costs increased by £6.9m to £53.4m, leaving a humble profit on the Corporation's own services of £129,122 (as against £2.5m the previous year). When losses on associated companies (£590,748 as against £767,895) and interest on capital (£2,377,724 as against £1,472,675) are taken into account, last year's results show a loss of almost £3m as against a profit of £¼m in 1956/57. These figures conceal a reduction in unit costs per c.t.m. from 40 to 39 pence (largely due to the kerosine-consuming Britannia, for the fuel cost per c.t.m. has been cut from 5.4 to 4.9 pence).

Because "the public have been offered facilities which are calculated to yield no more than a marginal profit . . . the world's airlines, particularly on the long-distance routes, have little or no margin to meet abnormal or unexpectedly adverse conditions." Various reasons are put forward to explain why this should hit B.O.A.C. especially hard: "The Corporation bears a charge for interest on the whole of its capital whether or not a profit is made . . . and has been subject to the added disadvantage of carrying an exceptional burden of expense and responsibility whenever they have been called upon to introduce a new British type of aircraft into service." Because of this, "the Corporation considers that it should be afforded some form of financial assistance at least for its service to the wider national interests of the export markets, if not in satisfaction of its legitimate claim to compensation for the additional costs which it has to bear compared with its competitors." But the explanation is not entirely external, for the report admits that "the Corporation is not satisfied with its unit costs of production, particularly in the engineering maintenance organization." (It is, of course, only a few months since Mr. Basil Smallpeice, in a staff letter, indicated that "the main reason why our costs are too high is that we spend about twice as much as comparable foreign airlines do on maintenance of aircraft for the same volume and quality of work.")

The increased interest charges are the result of raising new capital by Exchequer advances rather than by Government stock. While advances have increased from £10m to £41m, stocks have fallen from £60m to £59m, while bank loans have been reduced from £11m to £9m. Interest rates on stocks range from 3 to 4½ per cent but on advances from 5 to 5¾ per cent. Total borrowings accordingly amounted to £110m, or more than double the level of annual revenue.

Loss on the operations of associated companies has fallen from £767,895 to £590,748 despite the addition to the Corporation's portfolio of Hong Kong Airways, which last year lost £167,004. The airlines in which B.O.A.C. has invested showed an overall loss last year of £684,938 (revenue £9.9m, cost £10.6m) of which £614,828 is borne by the Corporation.

FRANCO-U.S. DISAGREEMENT

ON July 24 the French Government notified the U.S. State Department that the twelve-year-old bilateral air agreement between the two countries would be terminated. This means that, unless a new bilateral is negotiated before July 24, 1959, all air services between the U.S.A. and France by Air France, PanAm and T.W.A. will cease.

This extreme action by the French is a measure of their impatience with the American Government's unwillingness to grant Air France traffic rights on the U.S. West Coast. The French have sought these rights for a long time, intensively so since PanAm began to operate trans-polar services from California to Paris. (It will be recalled that when these flights were inaugurated the French threatened to withdraw the American airline's landing rights in Paris unless Air France were given reciprocal rights in California.)

There is no clear-cut answer to the question of who is right and who is wrong. The attitude of the U.S. Government in all its dealings with foreign requests for more U.S. gateways has usually been generous (for example, K.L.M.—who were already getting 14 times as much traffic from the U.S.A. as American carriers were lifting out of Dutch territories—were nevertheless granted Houston - Amsterdam and Curaçao - New York). The State Department's attitude to foreign carriers' requests for rights is that restrictions lead only to counter-restrictions. The U.S. trunk airlines, however, think differently. They are proud of their hard-won, unsubsidized industry (which they compare with the State-supported standing of most of their foreign competitors), and they are concerned at the dilution of traffic which they say results from the State Department's "handouts" to foreign carriers. They talk darkly of a return to Federal subsidy, and point out that though 67 per cent of all traffic between the U.S.A. and foreign countries is American in origin, only 63 per cent was carried in 1957 by U.S. flag airlines. (Respective figures for 1949 were, say the U.S. airlines, 60 per cent and 75 per cent.)

The French cannot deny that the majority of traffic between the U.S.A. and France is American in origin. But their argument, propounded until now with a good-humoured Gallic shrug of the shoulders, is: "This may be so—but it is only because of the attractions of France that they are travelling at all."

The U.S. State Department has probably been strongly influenced in its resistance to French demands by the high-pressure, highly organized lobbying and public relations of the American Air Transport Association. This organization may not have bargained for the threatened loss of its French market; but on balance it may have less to lose than has Air France. It remains to be seen whether a new bilateral will be negotiated before services are suspended 12 months hence. A possibly influential bargaining counter at the disposal of the French is, of course, the Air France order for 17 Boeing 707s.

SUPER AEROS FOR AEROFLOT

EARLIER this year Omnipol and the U.S.S.R. signed a sales agreement for the supply of 130 Super Aero 45s to Aeroflot. The aircraft will be equipped with a Czechoslovakian ten-channel radio working on frequencies between 108 and 132 Mc/s; skis for winter operation; and winterized engine-cowlings. Altimeters of Czechoslovak design will be installed later. The Super Aeros are to be used for irregular operations in parts of Russia where traffic density is insufficiently high for scheduled services.

The type has now achieved considerable sales success; the Czechoslovak health service uses Super Aeros for ambulance work and aircraft have been exported to France (for geological research), Canada, Switzerland, Egypt, India, Indonesia and, most recently, Brazil. During a recent sales tour in the Near East, special dust filters were fitted for operation in desert areas.

Terrapin, Ltd., wasted no time in erecting this prefabricated office block for B.E.A. at London Airport. Work on the 11,400 sq ft building started at 5 a.m. and was completed twelve hours later.

Radar Picture of London Airport—photograph by courtesy of Decca Radar Ltd.

Firestone

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2 Fewer and wider ribs for longer wear.
3 New tread rubber of increased efficiency for longer wear.
4 Skid resistors to increase traction and decrease tendency to skid burn.
5 Sized to permit increased clearance in wheel nacelles.
6 Safety-tensioned, Gum-dipped nylon cords and improved body stock give longer tyre body life.

More landings per tread—more treads per carcass.

Many sizes also available in Ribbed pattern.

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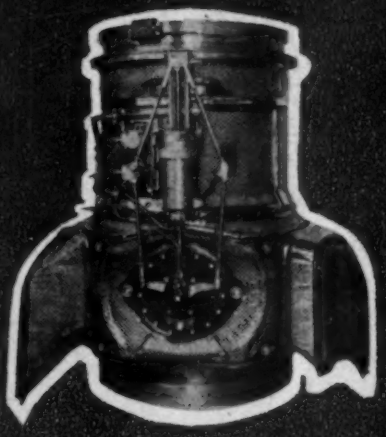
Success in our business doesn't merely mean the ability to manufacture, though we are extremely well equipped, even to the extent of having our own aluminium flux bath brazing plant.

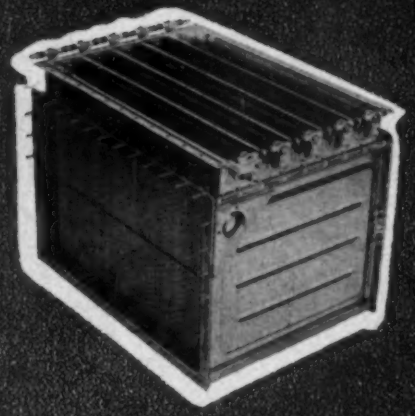
Success to us, means the ability to solve problems; to produce something that will do a new job, or perhaps an old job in never-before-experienced circumstances. And then, of course, to make it a practical and economical proposition.

We have forty years experience and wide resources. If we can help you in any way with heat exchange and insulation equipment, please contact us. We are always at your service.



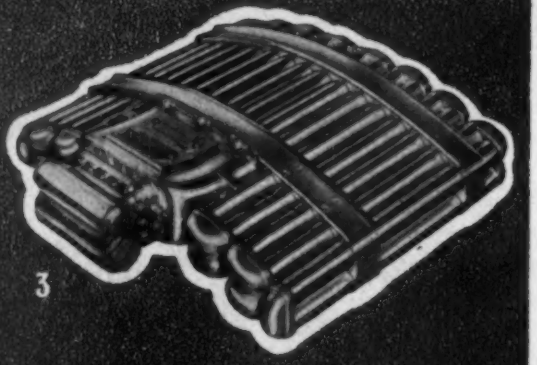
1

These thermal blankets are made of refractory fibre cased in .004 inch (.1016 mm) stainless steel. They are made-to-measure and are extremely light, the dimpled construction being responsible for their great strength. Specified for Rolls-Royce and Armstrong Siddeley jet and turbo-prop engines, these particular examples are shown fitted to the Rolls-Royce thrust reverser for the de Havilland Comet and Sud-Aviation Caravelle.



2

We design, manufacture and supply heat exchangers for many purposes in both aluminium alloy and stainless steel. This particular example is for the Vickers Vanguard's anti-icing system. Similar units are being supplied for the Fokker Friendship, the Bristol Britannia, the Armstrong Whitworth Freightliner and the Vickers Viscount.



3

High pressure fuel-cooled oil cooler for high performance gas turbine engines. This unit is used in the Armstrong Siddeley Sapphire S.A.7.

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CIVIL AVIATION . . .

BIGGER-PAYLOAD VANGUARD

STRUCTURAL changes introduced by Vickers-Armstrongs (Aircraft), Ltd., to the Vanguard airframe, have permitted an increase in payload from 25,000 lb to 29,000 lb—a figure that was quoted in *Flight's* "Commercial Aircraft of the World" special issue published last week. The revised weights have given rise to the nomenclature Vanguard Mk 2; but, as all Vanguards now ordered will be to this standard, the new designation will probably not be generally adopted.

Modifications have been made to the wing (to raise the zero fuel weight and to maintain the ratio of ZFW to landing weight), to the undercarriage and wheels and to the beam strength of the fuselage, in order physically to carry the extra payloads. Since the maximum take-off weight has not been changed, the effect of the structural revision has been (1) to increase slightly the empty weight; (2) to raise the ZFW, landing weight and payload; and (3) to reduce the range over which the maximum payload may be carried, as with the higher payload the same total amount of fuel is carried in the wings.

Vickers' aim has been to increase the attractiveness of the Vanguard on the short-haul sector of the range spectrum in order that they may offer the airlines a vehicle for generating seat-miles at lower costs than have ever previously been offered. Although committed to a long/medium-range jet themselves, they are more than prepared to argue the case for the short- and short/medium-range turboprop, particularly in the U.S.A., where there is considerable unease about speed competition in the face of the current recession in the rate of traffic growth.

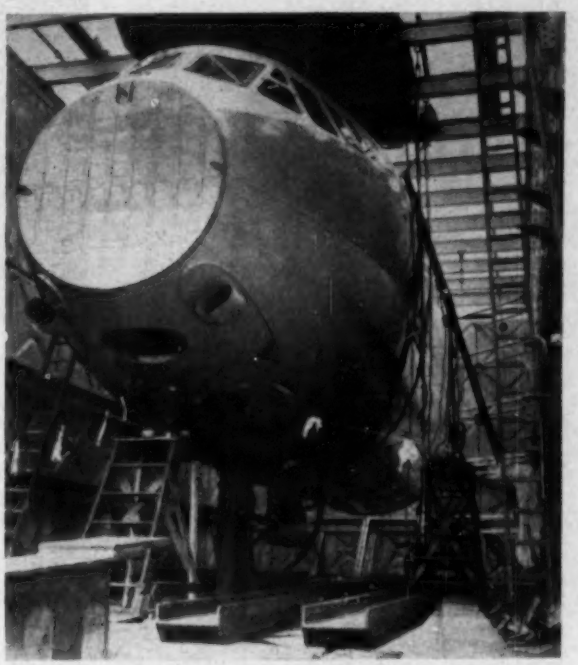
Naturally, the most impressive cost per seat-mile figures result from a study of the six-abreast, 139-seat Vanguard, with the aircraft used as a vehicle of mass travel at reduced airline fares; the manufacturers claim that a 30 per cent fare reduction should be possible on European stage-lengths of only about 250 st. miles, and 50 per cent on a selected 680-mile stage.

The deformation of the cost curve produced by increasing the weight-limited payload has resulted in a dog-leg effect that shows an improvement in seat-mile costs over the shorter (150-500 mile) ranges. This is an immediate result of the structural changes, but these would not themselves have been possible without increases in Tyne powers from Rolls-Royce and the 4,000 lb payload improvement is related to aircraft with 5,030 s.h.p. take-off power.

It will not be possible to take advantage of the airframe modification in every Vanguard built; the first 12 aircraft for B.E.A. have progressed too far to make retrospective incorporation possible. T.C.A.'s V.952s already have structural provision to carry a higher payload (25,000 lb, the V.950 specification standard) than the first V.951s for B.E.A., and discussions are in train with the Canadian airline about modification to the most recently announced standard. Although T.C.A.'s first aircraft is the seventh on the Weybridge production line, it is stiffened structurally to cater for a 25,000 lb payload (unlike the first 12 aircraft for B.E.A.) and could probably be modified if required.

The structure of the first Vanguard is now substantially complete; control surfaces are in place and painted, nacelles are finished, one Tyne powerplant is available for trial installation and systems are being added. The first aircraft should fly in about three months' time, by which time the second Vanguard (first for delivery for B.E.A.) will be in about the state that the first is in now. The third aircraft should follow in a further three months. Five aircraft are to be used to obtain certification (Boeing used three, plus the prototype-80, Douglas will use nine and Convair three), and the programme involves 1,600 flying hours.

The structural test programme is already under way; static strength tests will be carried out on a complete aircraft and a forward section of fuselage approximately 400in long is being tested in water to demonstrate the ultimate strength under pressure loads. This specimen includes such major cut-outs as windscreen, nosewheel bay and doors. The remainder of the aircraft is scheduled for a full programme of strength tests on all components under ground and flight loading; functioning tests on control surfaces, flaps and chassis, for example, will be carried out with the aircraft under load. After completion of these tests the two parts will be united and pressurized in air to ultimate pressure. Fail-safe tests will then be carried out under pressure and flight loadings.

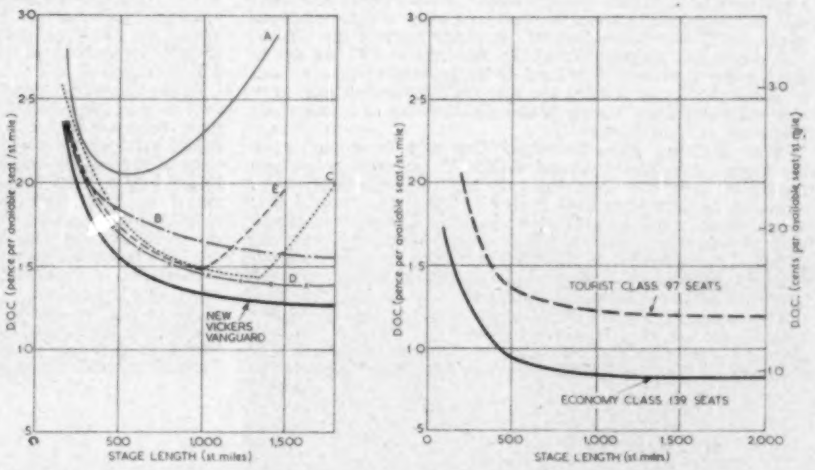


Ultimate strength under pressure of a 400in nose-section of the Vanguard is being determined by tests in this water tank.

The fatigue strength will be assessed from two major component-tests and numerous detail tests, many of which have already been completed. Measurements of rate of crack-propagation have also been made on samples of machined wing skins and fuselage pressure skins. The results of these detail tests will be compared with the large-scale tests on the front fuselage and on a torque-box representative of the integral tank structure.

The torque box is being tested under a loading spectrum typical of that expected to occur in service. Testing work to date represents 60,000 hr of flight and X-ray examination has revealed no cracks and no fuel leaks. It is intended to reproduce the dynamic effects of failure under static load in demonstrating fail-safe characteristics.

The fuselage component will be pressure-cycled in temperatures varying from −70 to +45 deg C; rates of crack propagation will be measured and the fail-safe performance assessed. Ground-resonance testing in the first complete aircraft is being carried out this week.

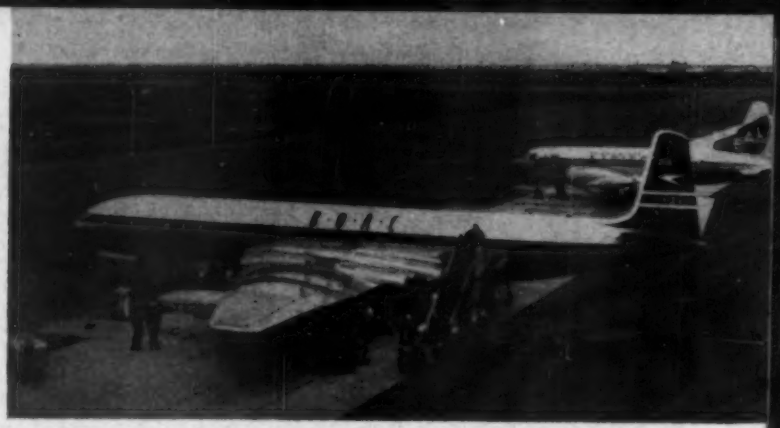


On the left is a European airline's analysis of direct costs for airliners with (A) twin piston engines, (B) four piston engines, (C) a medium-haul jet, (E) a medium-haul four-engined turboprop and (F) a short-to-medium-haul four-engined turboprop. Thrift-class seating is assumed throughout, with 138 seats in the Vanguard. At right are Vickers' curves of A.T.A. costs under U.S. conditions, with no allowance for freight. Changes can be made by varying the operating technique.

CIVIL AVIATION . . .

North Atlantic Jets

B.O.A.C. PREPARE TO INTRODUCE COMET 4s



ABOVE, on test in the hot-and-high airport conditions of Africa, is the first D.H. Comet 4. It is seen at Embakasi, Nairobi (5,327ft). While the aircraft was away, on July 27, the second Comet 4 G-APDB flew at Hatfield; this aircraft is expected to be delivered in September to B.O.A.C., who plan to open a transatlantic Comet service before the end of 1958. Background to these plans is discussed in this article.

NEXT month B.O.A.C. are due to receive from de Havilland the first of 19 Comet 4s. The type is thus making its final strides towards the long-sought goal—the reopening of British jet services.

Two events last week call for a review of the Comet situation: one was PanAm's official pronouncement that transatlantic Boeing 707-120 services will begin "this autumn" (which presumably means October or November); the other was the culmination of B.O.A.C.'s Comet 2E programme in the A.R.B.'s award of a 1,000-hr overhaul life to the Rolls-Royce Avon Mk 524 RA.29.

The possibility that PanAm might begin North Atlantic jet services in 1958 has existed for a long time; but in the last few months it has become a high probability. The Boeing 707-120 has progressed well through its trials, and the aeroplane is now about four months ahead of the schedule published by Boeing a year ago. PanAm took delivery of their first 707-120 on July 15, and will begin a 30-day training programme between New York and San Juan, Puerto Rico, on August 15. Six 707s will be delivered to PanAm before the year's end.

It was the prospect of PanAm's transatlantic 707 challenge that caused B.O.A.C. to reconsider their Comet 4 plans, which as recently as last April did not envisage transatlantic services. The inauguration of Comet 4 operations had been scheduled for February 1, 1959, on the Qantas-B.O.A.C. partnership route to Sydney. Last March it was suggested that B.O.A.C. were not likely to be easily persuaded to deviate from their cautiously laid plans to introduce Comets on to the Commonwealth routes. But B.O.A.C. could obviously not afford to let PanAm win a resounding commercial victory by being first across the North Atlantic with jets. And something more than commercial competition between two airlines was at stake: as on so many other occasions in air transport, matters of national prestige were involved. Britain could not let American jet services between New York and London go unchallenged. The Minister of Transport actually went on record as saying in New York: "Speaking for myself, I would like to see a British aircraft, especially the Comet, win the race if possible, so that all the sweat, blood and tragedy that went into it can pay off . . ."

The date on which B.O.A.C. are planning to start a Comet 4 service to New York remains a commercial secret: the Corporation's official reply to questions on this subject is, "it is hoped to start a once-weekly service before the end of 1958." But a target date exists, and all concerned intend it to be achieved, regardless of the competitive Pan American plans.

Despite the considerable Comet 2E experience and the existence of 20 fully trained jet captains, B.O.A.C. do not, however, intend to rush the Comet 4 into service. The weeks immediately after delivery will be taken up with type-conversion training (carried out away from London, probably at Stansted or Thurleigh), and a number of route-proving flights will be undertaken before the first service is operated. These will contribute towards the A.R.B.'s stipulated minimum of 100 hr flying "under route conditions" as a prerequisite of Comet 4 certification. In addition de Havilland will be conducting a series of overseas Comet 4 demonstrations next month, and these also will contribute towards the 100 hr.

According to plans published last March, B.O.A.C. are due to receive four Comet 4s from Hatfield by the turn of the year, and it was reported eight weeks ago that the Corporation intends to step up transatlantic Comet (Monarch) services to a once-daily frequency as from January 1.

What of Comet plans thereafter? One thing is certain: upon the Comet will largely depend B.O.A.C.'s competitive position during the next two years, until their Boeing 707s begin to be delivered in December 1959 (by which time the Comet 4 fleet should be at its full strength of 19 aircraft). The planned annual utilization is of an exceedingly high order—higher than anything previously attained by the Corporation's fleets, even in the post-Comet 1 emergency. Comets will be introduced on the routes to the Far East and Australia in 1959, and to South Africa in 1960.

The Comet 2E has just played an important prelude to Series 4 transatlantic services. It will be recalled that B.O.A.C. had two 2Es, one being their own, the other belonging to the M.o.S. The programme called for 7,000 Rolls-Royce Avon RA.29 hours to be flown by the end of May 1958. This was adjusted so that the final stages of the original programme (mainly flights to Beirut) could be completed on one aircraft on the North Atlantic route. Accordingly the M.o.S. Comet 2E G-AMXD ceased to be operated by B.O.A.C. in mid-May, and G-AMXK began a programme of transatlantic proving flights in June. This programme was in three phases, as follows:—

Phase 1: Eleven daily return flights to Gander, routed westbound via Keflavik.

Phase 2: Eight three-day trips, the first day consisting of a flight to Gander; the second day being devoted to flights from Gander to the Maritime airports of Goose, Stephenville, Sydney and Moncton, and return to Gander; return flight to London.

Phase 3: Eight further trips, as above to Gander on the first day, the second day being spent practising approach and let-down procedures at Baltimore, Montreal, Boston and New York. (At the latter airport one touch-and-go landing was made; there were no objections on the score of noise.)

Altogether B.O.A.C. flew 3,850 hr on Comet 2Es, of which 423 were on the North Atlantic.

So the re-inauguration of British jet services looks as though it will be as smooth as prudent and painstaking planning can make it. The Comet 4 airframe is a thoroughly known quantity; the engines will start off with the four-figure overhaul life that is the aspiration of all transport aero-engine designers and users; and B.O.A.C. have ready highly trained jet crews who know the aircraft and the route. But, of course, there are problems: for example, it looks as though the economical climb-cruise technique may not always be practicable, and that A.T.C. clearances for the more penalizing stepped-climbs will have to be accepted. This may affect the economy of operation: experience with the 2E between London and Gander showed that the penalty of two 4,000ft steps (compared with a climb-cruise) is about 650 kg of fuel load; obviously, four 2,000ft steps would be less penalizing (actually about 250 kg), but transatlantic quadrantal-height rules make 2,000ft steps impracticable.

This is a big subject, and B.O.A.C. have some strong views on it. They have been using Dectra (and Decca) on their 2E North Atlantic flights, which makes possible accurate *en route* track-keeping and lateral separation. This means that Dectra-equipped aircraft could theoretically be given a certain amount of latitude in their height selection—which is what jets may particularly require. But until everyone in the sky is using a foolproof track-keeping aid, such as Dectra promises to be, jets will not always be able to have the heights they want. There is no question that lack of A.T.C. choice will make Comet 4 operations unprofitable: the point is that operations might be *more* profitable if the present A.T.C. system could allow them to be operated nearer to their optimum requirements. In any event, all Comet services westbound are likely to make one stop—at Shannon, Gander or Keflavik depending on conditions—though 85 to 90 per cent of flights eastbound will be non-stop.

In the meantime, PanAm are hustling ahead, PanAm fashion, with their jet plans. They have much more to do in a much shorter time. No one in B.O.A.C. underestimates the American company's ability to do what it said it would do, efficiently and on time. But there is just one big question hanging over the 707: will its noise be accepted by New York? If not, the aircraft will either have to take off at a much restricted weight, or it will have to be fitted with more restrictive sound-suppressors. There is, of course, always the possibility that PanAm, if New York remains adamant about the 707's noise, will seek another less noise-conscious springboard —Baltimore or Philadelphia, perhaps. But if New York refuses entry, so will London.

All in all, the events of the next few weeks promise to be particularly fascinating, because in the course of them we shall see that dawn-of-a-new-era everyone has talked about, argued about, fretted about and looked forward to for so long.

J. M. R.

BREVITIES

THE chairman of Capital Airlines, Mr. J. H. Carmichael, resigned on July 22, according to *Aviation Daily*. No reason was given for the resignation, which was accepted "with deep regret" by the Board of directors.

* * *

Air Charter have acquired an ex-Northeast Britannia for use on charter and trooping flights. Designation is 307.

* * *

K.L.M. inaugurated services to Moscow with DC-6Bs on July 21. The reciprocal service with Aeroflot will be once weekly.

* * *

Straits Air Freight Express, Airwork's New Zealand subsidiary, recently carried 201.8 tons of freight in one day—claimed to be a world record.

* * *

Normal B.E.A. services to the Persian Gulf were restored on July 25, when a Viscount left London bound for Cyprus, Beirut, Kuwait and Bahrein. Services had been suspended for 11 days during the Iraq and Lebanon crises.

* * *

Mr. C. O. Turner, chief executive and general manager of Qantas, discussed the relations between Australian operators and the British aircraft industry last Monday evening in London. It is hoped to report his views in next week's *Flight*.

* * *

On July 27, B.O.A.C. introduced Britannia 312s on to their South and Central African routes in place of Britannia 102s. Scheduled flight-time from London to Johannesburg via Rome, Kano and Nairobi will be 25 hr 15 min (Kano is being used during the temporary unavailability of Khartoum).

New offices for Air-India were opened at 17-18 New Bond Street, London, W.1, on July 22.

* * *

Swissair opened new administrative offices at 54-62 Regent Street, London, W.1, on July 23.

* * *

Sud Aviation Alouette 2s have been used for regular, 12-minute helicopter services between Orly and Le Bourget since July 21.

* * *

Consulting engineers appointed by the Government of Kuwait for the development of its new international airport are Frederick S. Snow and Partners. Work will begin in about eighteen months.

* * *

Sir Gerard d'Erlanger, chairman of B.O.A.C., is reported to have stated in Nairobi on July 27 that the Corporation hopes to introduce economy fares on to its African services at fares 15 per cent lower than the present tourist level.

* * *

New Viscount 810s soon to be flown include aircraft for South African Airways; production deliveries to Lufthansa are due to begin during the last week of this month, the remaining eight following towards the end of this year and during early 1959.

* * *

Aviation Week reports that a development of the Convair 880, designated Convair 600, is now being offered to American Airlines. It has four G.E.X-220 turbofans of 13,000 lb thrust, more payload, higher gross weight, longer fuselage, and 1,000ft shorter take-off.

CLUB AND GLIDING NEWS

UNFAVOURABLE weather conditions marred the opening of the National Gliding Week last Sunday and only in the Scottish region competition, at Portmoak, could a start be made on time. There, the first day's task was an out-and-return race to the Lake of Monteith, a round trip of 78 miles. This was won by Geoffrey Stephenson in his Skylark 3 in 2 hr 22 min at an average speed of 32.4 m.p.h. Second was W. N. Tonkyn, also in a Skylark 3. At Dunstable, Sunday was declared a non-contest day, only one competitor getting away—W/C. N. W. Kearon of the R.A.F. team, who covered just over 13½ miles in his Skylark 3 before coming down. On Monday, W/C. Kearon flew 52 miles, landing near Ely Hospital, and the second-best distance was 26 miles (to Bassingbourn Aerodrome), by Mike Fairman in his Meise—the oldest machine in the contest. At Nympsfield, Sunday's flying was rained off and Monday declared a practice day owing to 40-50 kt winds. Tuesday's task was a distance flight, along a line through Coltishall.

TWO runways have now been made available at Goodwood by the Duke of Richmond and Gordon for private pilots wishing to attend race meetings, together with radio facilities under the control of G/C "Tim" Morice. Landing fees are 5s for a single-engined light aircraft, 7s 6d for twin-engined types and 10s for heavier machines. There is parking room for about 100 aircraft.

THE Leinster Aero Club, which is to hold its previously postponed air display this weekend (August 2 and 3), write to say that the programme is not yet finalized but is likely to include a Viscount 808 demonstration by Aer Lingus, contrasted with a fly-past by the type (a D.H. Dragon) with which the company began its operations; circuits by club pilots in Tigers, Chipmunks, Auster, Proctor, Messenger, Pipers, Swallows; a trapeze act by René Vincent of Paris, suspended under the club Auster; aerobatics by club pilots in Chipmunks; an exhibition of parachute supply-dropping by the Irish Parachute Club; a crop-spraying demonstration by Crop Culture (Aerial), Ltd.; a gliding display by the Dublin Gliding Club; a triple parachute drop by René Vincent; a fly-past of modern executive aircraft (Tri-Pacer, Apache, Bonanza); novelty and comedy acts by club pilots assisted by women members; and a delayed drop by the chief instructor of the Irish Parachute Club. They say that these items are certain, and they also hope to have shows by the Irish Army Air Corps, probably in Spitfires or Provosts, and by Peter Clifford in the Mew Gull; they are trying, too, for a visit by Mr. Bishop's "inverted" Tiger. Visiting pilots will be welcome.

ANOTHER club with an ambitious August Bank Holiday programme is the Plymouth Aero Club, who are holding a rally tomorrow (August 2) and on Sunday and Monday as part of the Plymouth Navy Week. A wide range of prizes is being presented to visitors coming by air, particularly those who time their arrival at Plymouth Airport, Roborough, between 1200 and 1300 hr, or on either hour. Subsequently there will be a *concours d'elegance*. The weekend's programme includes a conducted tour of the R.N. dockyard, Plymouth, a reception and barbecue at the clubhouse, an airborne sortie lasting half an hour over Plymouth and Dartmoor, and a visit to the B.B.C. transmitter at Hessary Tor. Roborough offers three grass runways, of 3,200ft, 2,800ft and 1,700ft and tower radio on 117.9 Mc/s. Visitors are expected to stay V.M.C. and those from abroad must land at Exeter for Customs clearance.

THE annual training camp of the Women's Junior Air Corps is being held at Hurn Airport, Christchurch, during this week and from August 2 to August 9. The programme includes lectures by Corps instructors on various aspects of aviation, and flying experience will be given in the Corps aircraft, Messenger G-AKZC, and—it is hoped—in a Tiger Moth. During the past week, tuition has been the responsibility of Miss Dorothy White, a qualified flying instructor who was one of the early W.J.A.C. flying scholarship winners.

A REALLY large-scale tea patrol is planned by the Elstree Flying Club for Sunday, August 10. The rules follow the usual pattern: visitors who pierce the screen of defending aircraft between 1545 and 1645 B.S.T. will be rewarded with free teas for the pilot and one passenger. The contest area is 1,200ft to 2,000ft above Elstree aerodrome (311ft a.m.s.l.) and extends to within 3,000 yd of the boundary. The programme can be held only in V.M.C. conditions; but if the weather is below these minima visitors will still be welcome and should approach by the safety lane via Luton and St. Albans. Elstree has 1,000 yd of tarmac runway in an east-west direction and 550 yd of grass on a north-east/south/west heading. A right-hand circuit is in operation when Runway 27 is in use.

Flown for the first time recently, the new Jodel D.140 four/five seater has already carried over a hundred passengers and its performance is said to be very satisfactory. Smartly finished in red and white, it has glass-fibre fairings and the cockpit canopy is tinted Plexiglas. Seventy-five have already been ordered.

SERVICE AVIATION

Royal Air Force and Naval Flying News

Importing their national game into the desert scene at Amman, Transport Command aircrew play an impromptu cricket match while their aircraft are unloaded during the recent airlift (described in last week's issue of "Flight") to the Jordan capital.

R.N.Z.A.F. Staff Post

APPOINTED Assistant Chief of Air Staff of the R.N.Z.A.F., A. Cdre. C. A. Turner (promoted from group captain when he took up his new duties on July 1) was formerly C.O. of R.N.Z.A.F. Ohakea. Prior to assuming command there —in June 1956—A. Cdre. Turner spent four years at the Air Department as Director of Organization and Staff Duties.

Coastal Command Shackletons

RE-EQUIPMENT of Coastal Command squadrons with Mk 3 Avro Shackletons is now "well under way" and should be completed by the end of this year. Stating this in the House of Commons on July 23 the Under-Secretary of State for Air, Mr. Ian Orr-Ewing, denied a rumour that the Air Ministry was prepared to wash its hands of re-equipping Coastal Command as it might be handed over to the Navy. "We are extremely interested in its future," he said, "and want to make sure it has the most modern equipment."

C.F.S. Commandant

MEMBERS of the C.F.S. Association who attended its annual dinner recently made the acquaintance there (as recorded in our report of July 18) of Little Rissington's new A.O.C. and Commandant, A. Cdre. J. N. H. Whitworth, who brings to the post a long and varied experience.

He took a C.F.S. course himself in 1936, then instructed for two-and-a-half years at Oxford U.A.S., where one of his pupils was G/C. G. L. Cheshire, V.C. During the war, A. Cdre. Whitworth flew with Bomber Command from its outbreak until September 1943, making his first trip in a Whitley of No. 10 Sqn. as a squadron leader and his last in a Lancaster as an air commodore. He was base commander at Scampton in 1943 when No. 617 Sqn. was formed under W/C. Guy Gibson for its attack on the Mohne and Eder dams (referred to in the "Barnes Wallis Tribute" on the opposite page). On May 2 this year A. Cdre. Whitworth flew in the first Vulcan to Scampton when No. 617 Sqn. was re-formed: sixteen years earlier he had delivered the station's first Lancaster. He holds the D.S.O. and D.F.C. and has been S.A.S.O. at No. 1 Group, Bomber Command, for the past three-and-a-half years.

Norwich Presentation

TO mark the 40th birthday of the R.A.F. and in commemoration of its many years of happy association with the city of Norwich a presentation was being made to the Mayor, Cllr. Norman R. Tillett, at the City Hall last Wednesday. Taking the form of a solid silver model of an Overstrand bomber (called after the Norfolk village of that name), the gift was to be handed over by A.V-M. K. B. B. Cross, A.O.C. No. 3 Group and a former commander of the Eastern Fighter Sector.

Unreserved Welcome

THERE was a particularly happy air about the welcome given to the Battle of Britain Fighter Association when it officially made its home at the R.A.F. Reserves Club on July 24. Sir Archibald McIndoe, who as the club's president and the great healer of so many Battle of Britain casualties had a double interest in the occasion, struck exactly the right note when he welcomed the new association; and Lord Dowding (who very humanly confessed that he was "one of those chaps who after making a speech wake up next morning and say, 'I wish I'd said that' ") unveiled a wall plaque which will provide a tangible reminder for the club of its new members' part in the brave days of 1940.

Glaswegians in Camp

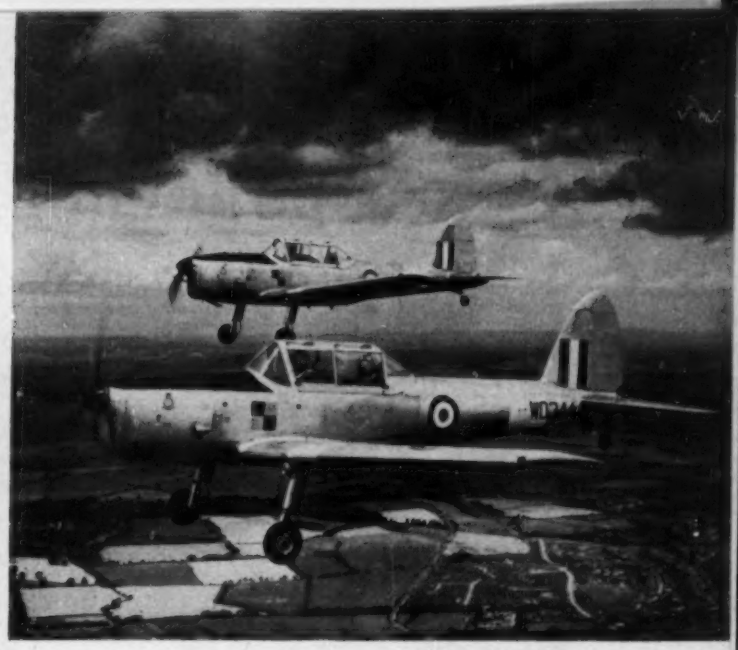
HOLDING their summer camp at R.A.F. Thorney Island, Glasgow U.A.S. were hampered by bad weather in their first flying period—June 25 to July 8—and as a result were only able to achieve 434 hr out of a target figure of 517 hr; but in the second period (a ten-day camp extending to July 29) conditions have been much more favourable and the target of 440 hr was very comfortably exceeded. By last Monday 458 hr had been flown.

But U.A.S. camps do not only consist of reaching target figures; one of Glasgow's preoccupations at Thorney Island has been visits by the Home Command Examining Unit, on its round of checks for the Hack Trophy, which Glasgow are desperately keen to wrest from London's grasp; and there is the more intangible consideration of the R.A.F. atmosphere which the student pilots absorb while living on a station. In this respect the squadron commander, W/C. H. A. England, has nothing but praise for Thorney Island and its C.O., G/C. H. E. C. Boxer, for the way they have made their summer visitors from north of the border feel "at home"—not only socially, by treating them as members of the station, but in practical ways like giving them an experience of A.S.R. with the aid of No. 22 Squadron's Sycamores. The U.A.S. members have also visited the Royal Naval dockyards at Portsmouth and been made honorary members of Thorney Island sailing club.

Glasgow U.A.S., as one of the Grade 1 university squadrons, has an establishment for 60 flying members. At present its strength is 49, but this is expected to be raised to the maximum when the new university term starts. About 80 per cent of the members (who include a Sikh, an Australian and a Nigerian as well as three

Scenes at the Glasgow U.A.S. summer camp at R.A.F. Thorney Island, referred to on these pages. Below left, the C.O., W/C. H. A. England, discusses a cross-country exercise with Cdt. Plts. W. H. Calder, G. R. Wing and P. T. Deakin; centre, Cdt. Plt. D. Dale alleviates any home-sickness his fellow-members may feel with the skirl of his pipes; and right, the C.F.I., S/L. G. N. Sims, discusses a tailplane adjustment with Mr. George Lever, Airwork charge-hand who has attended many Glasgow U.A.S. camps.

"Flight" photographs



"Flight" photographs

Chipmunks of Glasgow University Air Squadron, which (as recorded on these pages) has been on summer camp at R.A.F. Thorney Island, in formation over the South Coast. The aircraft were led by the C.F.J., S/L. G. N. Sims, and the photographs were taken from "Flight's" Gemini.

Englishmen) are studying science or engineering. The squadron's headquarters are in Glasgow but its flying is done at Scone, near Perth—some 70 miles away. Nevertheless, this arrangement works excellently; the weather factor is good and it means, says W/C. England, that as flying is mostly done at weekends the unit gets used to living together as a squadron. (Despite his English name the C.O., who won a D.F.C. on Lancasters in Bomber Command, is a Glasgow-born Scotsman.) At Scone the squadron competes annually for the Scone Trophy with the three other Scottish university squadrons. Maintenance of their T. Mk 10 Chipmunks, which bear the squadron's badge and black-and-yellow checker-board marking, is done by Airwork, Ltd., who presented the Scone Trophy. Most of the aircraft now carry the red fluorescent paint bands adopted by Home Command.

Recent Appointments

AMONG recent R.A.F. appointments announced by Air Ministry are the following:—

G/C.s W. N. Hibbert to AFCE for staff duties; P. H. Roscoe to H.Q., M.E.A.F., for administrative staff duties.

W/C. J. O. Gale to the R.A.F. Staff College, Bracknell, for directing staff duties (with acting rank of group captain); Wg/O. J. A. Bannantyne, W.R.A.F., to H.Q., Technical Training Command, for administrative staff duties (with acting rank of group officer).

W/C.s C. F. Babbage to R.A.F. West Drayton to command and as U.S.A.F. liaison officer; R. Broadbent to R.A.F. Wittering as O.C. Flying Wing; J. R. Gibbons to R.A.F. Bruggen as O.C. Flying Wing; H. M. S. Green to H.Q., No. 18 Group, for air staff duties; P. L. Hancox to Air Materiel Command, U.S.A.F., for exchange duties; H. A. Jenkins to R.A.F. Staff College, Bracknell, for directing staff duties; G. B. Johns to Air Ministry for duty in the Department of the Chief of the Air Staff; R. V. Moxey to H.Q., Maintenance Command, for technical staff duties; S. A. E. Munns to Air Ministry for duty in the Department of the Chief of the Air Staff; M. E. Pulvermacher to R.A.F. Pergamos, Cyprus, to command; P. H. Reason to the British Joint Services Mission, Washington; H. K. Rees to R.A.F. Marham as O.C., the Administrative Wing; D. H. Sutton to R.A.F. Aldergrove as O.C. Flying Wing.

S/L.s R. H. Benwell to H.Q., 2nd T.A.F., for German Air Force training duties (with acting rank of wing commander); R. F. Hitchcock to H.Q., No. 90 Group, as Senior Personnel Staff Officer (with acting rank of wing commander); A. Y. Mason to H.Q., No. 12 Group for operations (control and reporting) duties (with acting rank of wing commander); A. R. Scott to Air Ministry for duty in the Department of the Chief of the Air Staff (with acting rank of wing commander).

Comet Operations

STATISTICS for the Comet 2s operated by R.A.F. Transport Command were published recently by the de Havilland Aircraft Co., Ltd. In their first two years of service (one year in full scheduled passenger-carrying operation) these ten aircraft have flown 200m passenger miles; almost 100 scheduled return flights to the Far East have been made; 70 transatlantic and 60 trans-Pacific crossings have been carried out and 175 unscheduled passenger services have been flown, many of the latter at short notice. Canada to the United Kingdom in 4 hr 5 min (at an average speed of 610 m.p.h.) and the U.K. to Singapore in 17 hr 55 min are among the many fast flying times achieved by the R.A.F. Comets.

Barnes Wallis Tribute

PAYING tribute to Dr. Barnes Wallis recently, the Controller of the R.A.F. Benevolent Fund, A.V-M. Sir John Cordingley, said: "To him we owe not only the conception of the R.A.F. Foundationships but also it was his great unselfishness and generosity which made the plan financially possible as a memorial to the gallant and brilliant men who breached the Mohne, Eder and Sorpe dams in 1943, using the bomb which Dr. Wallis had invented in the face of terrific difficulties. It was the award which the Government gave him for his great invention that he devoted to the creation of the foundationships."

A.V-M. Cordingley was presenting prizes on July 22 to girls of Christ's Hospital at Hertford, where foundationships were set up in 1951 (and, at the same time, at Christ's Hospital for boys at Horsham) by the R.A.F. Benevolent Fund in partnership with Dr. Wallis, who is now treasurer of Christ's Hospital and chairman of the Council of Almoners. Each contributed £10,000 and in addition the fund makes an annual donation related to the costs. Subsequently the R.A.F.A. donated a further £10,000 to the R.A.F. Foundation's Trust.

IN BRIEF

Princess Margaret is to visit the R.A.F. Bomber Command station at Cottesmore, Rutland, on October 21.

* * * * *

No. 1 Sqn., R.A.A.F., which recently returned to Australia after eight years' operations in Malaya with Lincolns, is now to be re-equipped with Canberras.

* * * * *

S/L. J. de M. Severne has been appointed equerry to the Duke of Edinburgh. He succeeds W/C. H. Chinnery, who has now completed his tour of duty.

* * * * *

G/C. C. H. Simpson, formerly Assistant Commandant of the R.A.F. Staff College at Andover, arrived in Nairobi on July 22 to assume the appointment of Senior R.A.F. Officer East Africa. He succeeds G/C. E. G. Palmer.

* * * * *

At R.N.A.S. Yeovilton last Friday (July 25) the Duchess of Kent opened a social club for ratings and W.R.N.S. and their guests. Named the Heron Club, it is the first conversion of its type from a Naafi canteen ever made on a Naval station.

* * * * *

The Trans-Canada (McKee) Trophy for 1957 has been awarded to W/C. J. G. Showler, who is at present on the R.C.A.F. headquarters staff in Ottawa, "for his general contribution to the successful and accurate mapping of the Arctic" when C.O. of No. 408 Sqn. at Rockcliffe.

* * * * *

Commissioned rank is to be granted, as from the beginning of August, to all R.A.A.F. pilots and navigators graduating from flying school. Previously their rank was sergeant, now it will be pilot officer—"in recognition of the increased responsibility and skill demanded by the development of Service aircraft."

* * * * *

The Queen has approved unit badges and mottos for a number of R.A.F. units in the U.K. and overseas, among them No. 543 Sqn. of Bomber Command, the M.E.A.F. staging posts at Idris and Bahrein, and No. 103 M.U. at R.A.F. Akrotiri. No. 543 Sqn., which is based at Wyton and equipped with Valiants, has the motto "Valiant and Vigilant."

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns; the names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

No. 12 Squadron's fox insignia on a Canberra (see letter below).

Fairey Fox Perpetuated

THOSE of us now serving with No. 12 Squadron were very interested in the recent letters concerning the fox's head on our aircraft. I thought that your correspondents would like to see the enclosed photograph of our present insignia.

Apart from being part of the squadron's badge, the fox's head seems to have disappeared from the squadron's aircraft during the war, and it has only been reinstated during the last two weeks. Prior to that we had a red silhouette of a loping fox painted on the aircraft fins. We weren't very fond of this particular insignia, and for some months have been planning to bring back the fox's head.

That it has been brought back is largely due to the craft and hard work of a very gifted officer now serving with us. This officer has reproduced in full colour the fox's head of the Squadron badge. To do this he cut seven stencils. The head is mounted in a white circle and the fin itself has been painted green. At a risk of appearing immodest we are all very pleased with the result and hope that former members of this very old squadron will be pleased to know that the original insignia still adorns our aircraft, if anything in an improved form.

R.A.F. Binbrook, Lincs. A. C. BLYTHE, W/Cdr.

Air Race Afterthoughts

NOW that the Coventry Air Pageant is over for another year I feel that some comments on the races and aerobatic competition would not be out of place.

All who were present would, I think, agree that criticism of the handicappers was, as usual, widespread (one disgruntled competitor even went so far as to leave for home before the final day). This regrettable atmosphere seems to me to be inevitable and will surely persist so long as competitors are allowed to fly early rounds of the races at less than full power and so mislead the hard-working handicappers to the extent of ensuring success for themselves in the later rounds. Some will say that this is a legitimate stratagem, but surely the crux of the matter is this: are the races intended to be a contest of flying skill between pilots, or a battle of wits between pilots and handicappers? If the former is the case—and I sincerely hope that this is so—then I would suggest that the organizers should seriously examine the possibility of altering the rules in such a way as to give the handicappers a better chance to do their job successfully.

One way would be to rule that the races must be flown at full throttle and that pilots would have to account to the stewards for any considerable discrepancies between lap times, with disqualification the possible penalty. In case this seems an extreme measure to take, I would point out that considerable sums of money are involved and that the basic idea of handicapping is to give all competitors an equal chance—an ideal which is not at present being realized.

One other comment concerns safety. May I suggest that in future the take-off path of aircraft starting late should be, so far as is possible, outside the course? This would avoid the danger of a back-marker taking off across the path of an aircraft rounding the aerodrome turn, as was seen at this year's meeting.

To turn now to the aerobatic competition. As one of the competitors I can think of no valid reason why the judges should so stubbornly persist in their refusal to publish the order in which the eliminated pilots had been placed. When discussing the matter after the event with some of the judges, I was given various so-called reasons for not publishing the full list of placings, but none seemed to make any sense. The main objection seemed to be that the lowly placed might be unduly discouraged! Were this extraordinary reasoning to be applied to other sports, there would, I am sure, be an immediate outcry. After all, having devoted much time and money to entering and practising for a competitive event, surely the competitor has a *right* to know where he has been placed in the finishing order. I am sure I am voicing the opinions of the majority of the British pilots who took part this year.

Despite the above criticisms I have nothing but admiration for the overall efficiency displayed by all those who play a part in organizing the Air Pageant, which from the pilots' viewpoint is surely a model of control without over-control.

Teddington, Middx. D. M. HARTAS.

HAVING read in your report of the air racing at Coventry that the Comper Swift G-ABUS was being flown by Mr. D. F. Ogilvy "incidentally for the last time," I feel this may imply that the Comper will no longer take part in air races.

As you may already know. the Comper has been in my possession since 1939 but since then has been loaned by me firstly to Sir Basil Embry, who kept it at Wittering for several years when he was commanding that station, secondly to Mr. A. L. Cole, who flew the machine in several races, and lastly to Mr. Ogilvy.

It is true that the Comper has now been transferred to Sywell, but I am certainly hoping to enter her in races next year, during some of which she may well be flown by Mr. Ogilvy.

Perhaps you would be good enough to let your readers know that the Comper is still in the land of the living!

Wilbye, Northants. A. J. LINNELL.

Green Engines

THE letter published on July 11 from Mr. Cowley about Mr. Green and his engines reminds me of a conversation I had with Roy Chadwick 31 years ago, about the Avro Baby which Bert Hinkler had been flying about that time. He told me that the 35 h.p. Green engine with which it was powered had been used for years as the powerplant in the sawmill of the A. V. Roe works at Hamble. With no suitable aero engine available at that time, it was decided that the only thing to do was to uproot the Green from its concrete base and recondition it. Heavily coated with grime and sawdust, the little engine was taken to a bench, cleaned and stripped down. It was found to be in remarkably good condition internally, considering the arduous work it had performed, and, said Chadwick, proved to be wonderfully reliable when employed in the aircraft.

London, S.W.1. GRENVILLE MANTON.

Cody's Kites

YOUR correspondent Mr. Hurren (*Flight*, July 4) asks, "Who was the first man (or boy) to ascend in Cody's man-lifting kites? The answer is, Cody himself. He would allow no one to ascend until he had proved them to be safe. Afterwards his son Leon went up, first with a tethering rope, preventing his going too high, and then in full control. Members of Cody's staff also went up tethered, but were not allowed "free" flight. Vivian Cody also went up in free flight soon after Leon.

On one occasion Leon Cody went up to over 3,000ft and overran the stop on the cable. His kite jammed and the pulleys froze. Cody, wondering why he was staying aloft so long, eventually hauled him down by the winch, to find that his son was almost frozen. Later, at the Crystal Palace, Cody gave "captive flights" to several boys, one of whom was Geoffrey Dorman. I understand from Vivian Cody that he was with Sir Ernest Shackleton on this occasion.

Sir John Boothman flew in Cody's second aeroplane when he was ten years old, but I doubt if he flew in a man-lifting kite, as they were all operated by the Royal Engineers from 1906 onwards. Duncan Davis probably had a ride when he visited Cody whilst on holiday.

Virginia Water, Surrey. G. A. BROOMFIELD.

FORTHCOMING EVENTS

July 26-Aug. 4. B.G.A.: National Soaring Week.
Aug. 1-16. Czech Aero Club: World Parachute Championship, Bratislava.
Aug. 2. R.N. Air Station Brawdy, near Haverfordwest: At Home.
Aug. 2-4. Plymouth Aero Club: Rally.
Aug. 2-4. S.M.A.E.: Model Aircraft World Championships, College of Aeronautics, Cranfield.
Aug. 9. R.N. Air Stations Yeovilton, Somerset, and Lee-on-Solent, near Fareham: At Homes.
Aug. 16-17. Alsace Aero Club: Rally des Vins, Alsace.
Aug. 31. Oxford Aeroplane Club: At Home, Oxford Airport.
Sept. 1-7. S.B.A.C. Display and Exhibition, Farnborough.
Sept. 8-13. International Congress of Aeronautical Sciences, Madrid.
Sept. 21. B.G.A.: National Sailplane Aerobatic Contest, Dunstable.
Sept. 21. Royal Belgian Aero Club: 900 cu m Balloon Competition.
Sept. 21. Milan Aero Club: Rally.
Sept. 26-29. Austrian Aero Club: Innsbruck Rally.

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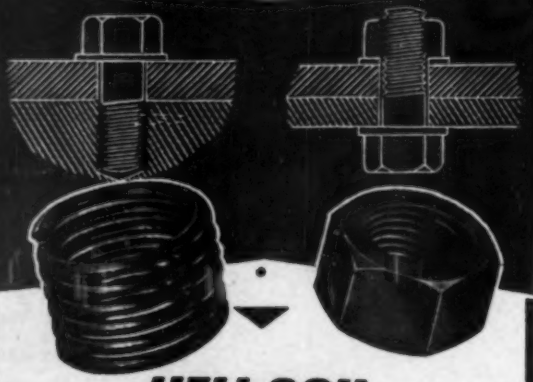

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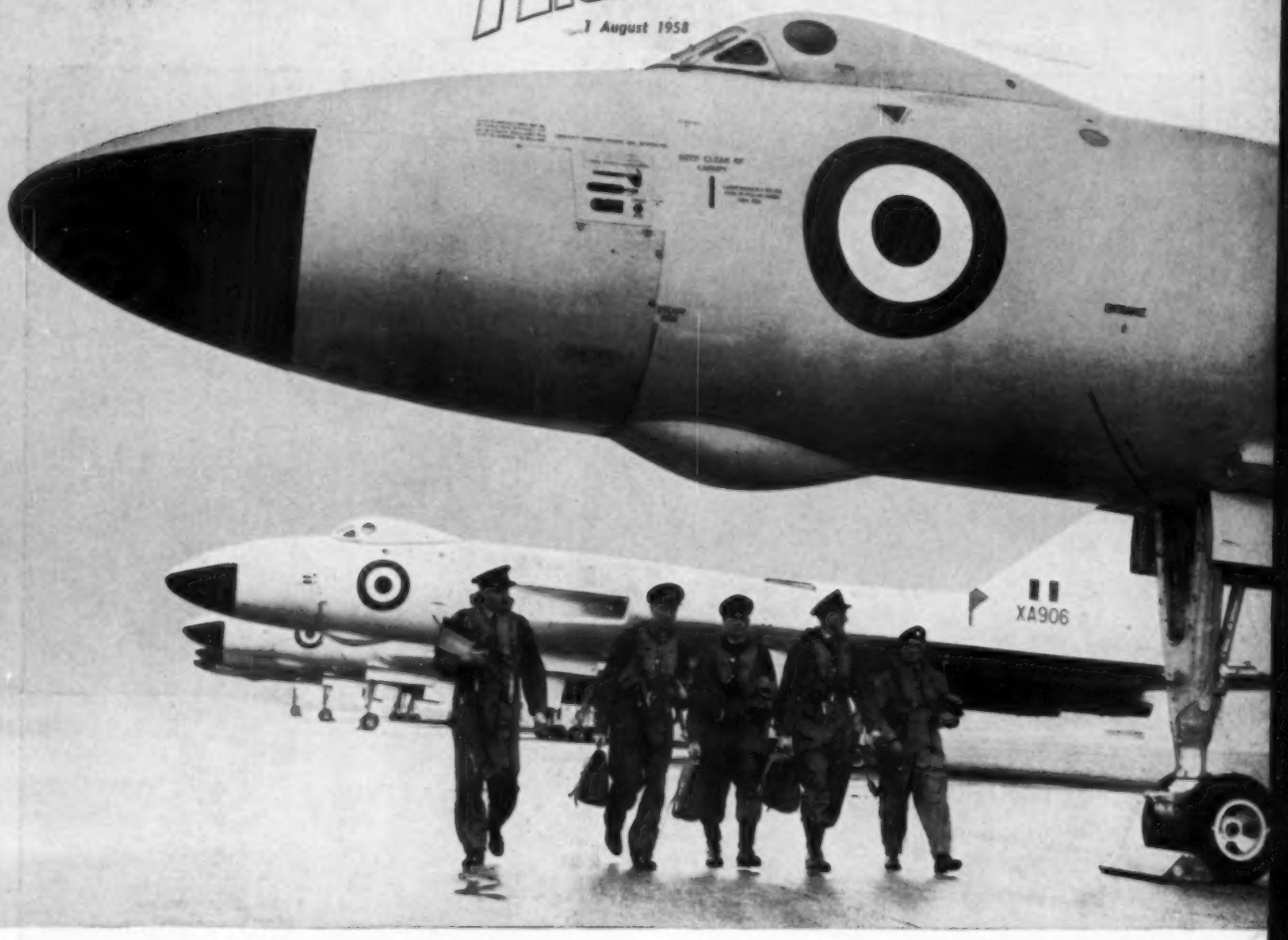


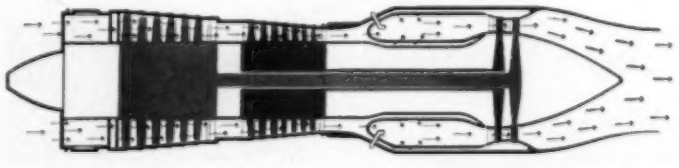
BRISTOL OLYMPUS
praised by VULCAN PILOTS

Twin-spool system gives Olympus rapid response, great power and low fuel consumption at all altitudes

Bristol Olympus turbojets have received high praise, particularly for their rapid response, from pilots of the RAF's Vulcan bombers. These pilots regularly put the Olympus through "slam" accelerations and decelerations at altitudes well above 50,000 ft—the most severe test for a turbojet. The Olympus responds magnificently every time.

Olympus owes its excellent response to the Bristol-pioneered twin-spool system. Because of this, Olympus can be accelerated from idling to maximum speed in 5 seconds—without surge. The twin-spool system gives the Olympus a unique combination of light weight with high power and low specific fuel consumption at all altitudes.

The Bristol Olympus has been type tested at 16,000-lb thrust. It has already run at observed thrusts of over 17,300 lb—without reheat. Olympus is capable of development into the 20,000-lb thrust class. A version of this turbojet—the Wright Zephyr—has been jointly developed by Bristol and Curtiss-Wright.



Gas-flow diagram of Bristol Olympus, illustrating twin-spool principle: low-pressure system in grey, high-pressure system in black.

Bristol Siddeley

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